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J952-11

WORLD POPULATION
and
FERTILITY PLANNING TECHNOLOGIES

THE NEXT 20 YEARS

OTA Reports are the principal documentation of formal assessment projects. These projects are approved in advance by the Technology Assessment Board. At the conclusion of a project, the Board has the opportunity to review the report but its release does not necessarily imply endorsement of the results by the Board or its individual members.

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Foreword

By the year 2000, the world's population is projected to increase by between 1.5 billion and 2.1 billion people. About 92 percent of this rise will take place in the less developed countries (LDCs). Birth rates are falling in most of these countries, but because the largest generation of young people in history is reaching childbearing age, the annual increase in global numbers is expected to rise from 80 million this year to 95 million annually by 2000.

Rapid population growth in the last 20 years is a result of improvement in health and agriculture technologies. Increased options for fertility change have also resulted from advances in science and technology. Because its mission includes foresight on emerging issues related to science and technology, OTA determined in 1978 that an objective analysis was timely and appropriate in providing Congress with improved insight in this area. The topic was discussed with Members of Congress and letters endorsing the study were received from the House Committee on Foreign Affairs, the House Committee on Science and Technology, and the former Subcommittee on Child and Human Development of the Senate Labor and Human Resources Committee. Permission to undertake the study was granted by OTA's Technology Assessment Board in response to a request by the Director.

This report covers the status of current and projected technologies that affect fertility change. It presents current projections for population growth to 2000 and the implications of this growth; identifies the determinants of fertility change; reviews current reproductive research and contraceptive R&D; discusses the factors that influence the acceptance, distribution, and use of fertility planning technologies in LDCs; and examines past and current U.S. funding arrangements in support of population assistance requests from LDCs.

Issues and options developed for Congress include Federal support of contraceptive R&D; product liability and the contraceptive industry; effective patent life; export of non-FDA approved drugs; levels of funding for international population assistance; and distribution of population assistance funds.

The Office of Technology Assessment was assisted in the preparation of this study by an advisory panel of individuals representing a wide range of backgrounds, including demographic and family planning research, the pharmaceutical industry, health policy analysis, ethics and philosophy, and organizations holding differing views on current reproductive issues. Sixty-six reviewers drawn from universities, nongovernmental agencies, and the private sector provided helpful comments on draft reports.

The Office expresses sincere appreciation to each of these individuals. As with all OTA reports, however, their content is the responsibility of the Office and does not necessarily constitute the consensus or endorsement of the advisory panel or the Technology Assessment Board.

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Glossary

Abortion rate.—The estimated number of abortions per 1,000 women aged 14 to 44 in a given year.

Age-sex structure.—The composition of a population as determined by the number or proportion of males and females in each age category. The age-sex structure of a population is the cumulative result of past trends in fertility, mortality, and migration. Information on age-sex composition is an essential prerequisite for the description and analysis of many other types of demographic data. (See also *population pyramid.)*

Amenorrhea.—The absence or suppression of menstruation, normal before puberty, after the menopause, during pregnancy and lactation.

Antinatalist policy.—The policy of a government, society, or social group to slow population growth through efforts to limit the number of births.

Artificial insemination.—Introduction of semen into the uterus or oviduct by other than natural means.

Baby boom.—The period following World War II from 1947 to 1961 marked by a dramatic increase in fertility rates and in the absolute number of births in the United States, Canada, Australia, and New Zealand.

Barrier method.—A contraceptive method that establishes a barrier between the joining of sperm and ovum; e.g., condom, diaphragm, cervical cap.

Basal body temperature method.—See *periodic abstinence methods.*

Billings method.—See *periodic abstinence methods.*

Birth interval.—The length of time that has elapsed between one live birth and the next, or between marriage and the first live birth, or between the time of last live birth and the time of inquiry; normally measured in months. In contrast to pregnancy intervals, live birth intervals may include pregnancies that did not end in live births; for example, a live birth interval could be a live birth, followed by a stillbirth, followed by another pregnancy resulting in a live birth. The live birth interval would include the entire period between the two live births. (See *pregnancy interval.)*

Birth rate (or crude birth rate).—The number of births per 1,000 population in a given year. Not to be confused with growth rate.

Census.—A canvass of a given area, resulting in an enumeration of the entire population, and the compilation of demographic, social, and economic information pertaining to that population at a specific time. (See also *survey.)*

Childbearing years.—The reproductive age span of women, assumed for statistical purposes to be 15 to 44 in the United States. In other countries, the range is often set at 15 to 49.

Cohort.—A group of people sharing a common temporal demographic experience who are observed through time. For example, the birth cohort of 1900 would be the people born in that year.

Completed fertility rate.—The number of children born per woman in a cohort of women by the end of their childbearing years.

Conception.—Generally the beginning of pregnancy, but in a theological context sometimes the point at which a new life, in the sense of a new soul, begins. Conception is usually equated with the fertilization of the ovum by the sperm, but is sometimes equated with the implantation of the fertilized ovum in the uterine lining. The exact definition is of some significance when attempts are made to classify fertility planning methods as either contraceptive or abortifacient.

Consensual union.—Cohabitation by an unmarried couple for an extended period of time.

Crude birth rate.—See *birth rate.*

Continuation rate.—The proportion of those adopting a method of contraception who continue with it for a given period.

Contraceptive.—An agent or device used to prevent conception.

Contraceptive failure rate.—The ratio of the number of conceptions occurring during a given period to the number of person months lived by a group of women or couples during which contraception or a particular contraceptive is used.

Contraceptive prevalence rate.—A measure of the extent of contraceptive practice among the population at risk of conception, calculated as the ratio of the number of women known or supposed to be practicing contraception at a given time to the total number of eligible women (generally those fecund, nonpregnant, married women) in that population.

Death rate (or crude death rate).—The number of deaths per 1,000 population in a given year.

Demographic transition.—The historical shift of birth and death rates from high to low levels in a population. The decline of mortality usually precedes the decline in fertility, resulting in rapid population growth during the transition period.

Demography (Greek, demos [people] graphie [study]).—The scientific study of human populations, including their size, composition, distribution, density, growth, and other demographic and socioeconomic characteristics, and the causes and consequences of changes in these factors.

Dependency ratio.—The ratio of the economically dependent part of the population to the productive part; arbitrarily defined as the ratio of the elderly (those 65 years and over) plus the young (those under 15 years of age) to the population in the "working ages" (those 15 to 64 years of age).

Depo-Provera.—See *injectable contraceptives.*

Doubling time.—The number of years required for a population of an area to double its present size, given the current rate of population growth.

Effectiveness.—Clinical or theoretical effectiveness is measured by the failure rate of contraceptive methods under conditions as close to ideal as possible, usually under skilled supervision, with care taken to see that they are invariably and correctly used. Use effectiveness is measured by the failure rate of contraceptive methods when used by the general population, without careful medical supervision, so that failures may be due to intermittent or incorrect use. Demographic effectiveness is measured by measuring changes in the fertility of a population after a particular fertility planning method or program has been introduced.

Emigration.—The process of leaving one country to take up residence in another.

Emigration rate.—The number of emigrants departing an area of origin per 1,000 population at that area of origin in a given year.

Estrogen.— Any natural or artifical substance that induces estrogenic activity; more specifically the estrogenic hormones estradiol and estrone produced by the ovary; the female sex hormones.

Exponential growth.—A constant rate of growth applied to a continuously growing base over a period of time; for example, a savings account increasing at compound interest; a snowball gathering mass; a population growing at 3.0 percent annually.

Failure rate.—See *contraceptive failure rate.*

Fallopian tube.—The tube or duct that extends laterally from the lateral angle of the uterus, terminating near the ovary. It serves to convey the ovum from the ovary to the uterus and spermatazoa from the uterus towards the ovary.

Family planning.—The conscious effort of couples to regulate the number and spacing of births. Family planning usually connotes the use of contraception to avoid pregnancy, but also includes efforts of couples to induce pregnancy.

Fecundity.—The physiological capacity of a woman, man, or couple to produce a live child.

Fertility.—The actual reproductive performance of an individual, a couple, a group, or a population.

Fertility rate.—See *general fertility rate.*

Fertilization.—Penetration of an ovum by a spermatazoon. Usually occurs in the fallopian tube, following ovulation in the menstrual cycle, and is usually considered to be the moment of conception as it is the time when the two sex cells unite.

General fertility rate. (also referred to as *fertility rate).*—The number of live births per 1,000 women aged 15 to 44 years in a given year. (See also implantation.)

Gonadotropin.—A substance having affinity for or a stimulating effect on the gonads. There are three varieties: anterior pituitary, chorionic from human pregnancy urine, and chorionic from the serum of pregnant mares.

Gossypol.—A derivative of the cottonseed plant known to induce infertility in males; now being tested as a male contraceptive in China.

Growth rate.—The rate at which a population is increasing (or decreasing) in a given year due to natural increase and net migration, expressed as a percentage of the base population.

Immigration.—The process of entering one country from another to take up permanent residence.

Implantation.—Process whereby a fertilized ovum burrows into the lining of the uterus on its arrival there, and attaches itself firmly. Successful implantation is essential to the future development of the fetus and is sometimes considered as the true moment of conception.

Infant mortality rate.—The number of deaths to infants under 1 year of age in a given year per 1,000 live births in that year.

Infertility.—Failure, voluntary or involuntary, to produce live born children on the part of an individual, a couple, or a population.

Injectable contraceptives.—The most commonly used injectable progestins, given at 3-month intervals, are Depo-Provera (DMPA) or medroxyprogesterone acetate, and norethindrone enanthate.

Integration.—In the family planning context, integration refers to linkage of family planning services delivery with some other program, usually health, MCH, or other rural development activity (electrification, agriculture, nutrition, parasite control). The linkage is at either the administrative or the service end. At the administrative level it is the creation of an umbrella organization with administrative control over a large array of services; at the service level, specialized services are linked at the point of service delivery.

In vitro.—Outside the living organism and in an artificial environment.

Less developed country.—For purposes of this report, all countries, territories, or areas in Latin America and the Caribbean, all in Africa other than the Republic of South Africa, all in Asia other than Japan and the U.S.S.R., and all in Oceania other than Australia and New Zealand. LDCs tend to be characterized by low per capita gross domestic product (GDP), a low share of manufacturing in GDP, low rates of annual increase in total GDP, low proportions of people with basic training or technical skills, and low literacy rates among those 15 or older. (See *more developed country.*)

Life expectancy.—The average number of additional years a person would live if current mortality trends were to continue. Most commonly cited as life expectancy at birth.

LRF analogs.—Numerous analogs (chemically different but reactively similar to the parent substance) of the luteinizing hormone releasing factor (LRF), a hypothalamus-controlled secretion from the anterior pituitary gland, are under study as contraceptives and agents to treat infertility. Both long-acting agonists (stimulators) and antagonists involve inhibition of ovulation; luteolysis; and inhibition of spermatogenesis and testosterone secretion. Possible routes of administration include subcutaneous, intramuscular, sublingual, rectal, intravaginal, and intranasal.

Marital fertility rate.—Number of legitimate live births per 1,000 married women aged 15 to 44 in a given year.

Maternal mortality rate.—The number of deaths to women due to pregnancy and childbirth complications per 100,000 live births in a given year.

Menarche.—The beginning of menstruation; i.e., the first menstrual period. This occurs during puberty but does not signify the beginning of full adult fecundity as ovulation may be irregular or absent for some time.

Menopause.—Cessation of menstration; i.e., the last menstrual period or the end of a reasonably regular menstrual pattern. After the menopause is completed a woman is permanently sterile.

Migration.—The movement of people across a specified boundary for the purpose of establishing a new permanent residence. Divided into international migration (migration between countries) and internal migration (migration within a country).

Mini-laparotomy.—Female sterilization procedure in which the fallopian tubes are ligated or cauterized through a small abdominal incision.

Mini-pill.—Oral contraceptive containing no estrogen and generally less than 1 mg of a progestational agent.

Morbidity.—The frequency of disease and illness in a population.

More developed country.—For purposes of this report, all countries of Europe, North America (Bermuda, Canada, Greenland, St. Pierre and Miquelon, and the United States), Australia, New Zealand, Japan, and the U.S.S.R. (See *less developed country.*)

Mortality.—Death as a component of population change.

Natural family planning.—See *periodic abstinence.*

Natural fertility.—The fertility of persons or populations in which deliberate control of childbearing (through use of abstinence, contraception, induced abortion, sterilization, etc.) is not practiced. Sometimes used loosely to signify the maximum fertility biologically possible; i.e., that of a normal healthy person or group of persons engaging regularly in sexual intercourse during the reproductive span with no attempt to restrict childbearing. The fertility of such populations will be determined by such factors as marriage customs, breastfeeding practices, and similar social and economic factors, and will therefore probably fall short of the biological maximum of fertility.

Natural increase.—The surplus (or deficit) of births over deaths in a population in a given time period.

Negative population growth.—A net decrease in the size of a population.

Net migration.—The net effect of immigration and emigration on an area's population in a given time period, expressed as increase or decrease.

Net migration rate.—The net effect of immigration and emigration on an area's population, expressed as increase or decrease per 1,000 population of the area in a given year.

Oral contraceptives.—Various progestin/estrogen or progestin compounds in tablet form taken sequentially by mouth; the "pill." Estrogenic and progestational agents have contraceptive effects by influencing normal patterns of ovulation, ovum transport, implantation, or placental attachment.

Ovulation.—The release of an ovum from the ovary during the female menstrual cycle.

Ovulation method.—See *periodic abstinence methods.*

Parity.—The number of live births a woman has had; a woman of zero parity has had no live births, a woman of parity one has had one live birth, etc.

Periodic abstinence methods.—Contraceptive methods that rely on timing of intercourse to avoid the ovulatory phase of a woman's menstrual cycle; Natural Family Planning. The Basal Body Temperature (BBT) method uses daily temperature readings to identify the time of ovulation; in the ovulation or Billings method, women are taught to identify the relationships of changes in cervical mucus to fertile and infertile days; the Sympto-Thermal method charts both changes in temperature and cervical mucus and teaches recognition of other symptoms of ovulation (i.e., intermenstrual pain).

The "pill."—See *oral contraceptives.*

Population.—A group of objects or organisms of the same kind.

Population density.—Population per unit of land area; for example persons per square mile, or persons per square kilometer of arable land.

Population distribution.—The patterns of settlement and dispersal of population.

Population increase.—The total population increase resulting from the interaction of births, deaths, and migration in a population in a given period of time.

Population momentum.—The tendency for population growth to continue beyond the time that replacement level fertility has been achieved because of a relatively high concentration of people in the childbearing years.

Population policy.—Explicit or implicit measures instituted by a government to influence population size, growth, distribution, or composition.

Population projection.—Computation of future changes in population numbers, given certain assumptions about future trends in the rates of fertility, mortality, and migration. Demographers often issue low, medium, and high projections of the same population, based on different assumptions of how these rates will change in the future.

Population pyramid.— A special type of bar chart that shows the distribution of a population by age and sex. Most countries fall into one of three general types of pyramids: 1) Expansive—a broad base, indicating a high proportion of children and a rapid rate of population growth; 2) Constrictive—a base that is narrower than the middle of the pyramid, usually the result of a recent rapid decline in fertility; and 3) Stationary—a narrow base and roughly equal numbers in each age group, tapering off at the older ages, indicating a moderate proportion of children and a slow or zero rate of growth.

Pregnancy interval.—Length of time that has elapsed between the end of one pregnancy and the end of the next, or between marriage and the end of the first pregnancy or between the end of the last pregnancy to occur and the time of inquiry; normally measured in months (See *birth interval*).

Prevalence rate.—See *contraceptive prevalence rate.*

Progesterone.—A steroid hormone obtained from the corpus luteum, adrenals, or placenta. It is responsible for changes in uterine endometrium in the second half of the menstrual cycle preparatory for implantation of the blastocyst, development of maternal placenta after implantation, and development of mammary glands.

Progestin.—A corpus luteum hormone that prepares the endometrium for the fertilized ovum. This word is now used to cover a large group of synthetic drugs that have a progesterone-like effect on the uterus.

Pronatalist policy.—The policy of a government, society, or social group to increase population growth by attempting to raise the number of births.

Prostaglandin.—Refers to a group of naturally occurring, chemically related long-chain fatty acids that have certain physiological effects (stimulate contraction of uterine and other smooth muscles, lower blood pressure, affect action of certain hormones).

Rate of natural increase.—The rate at which a population is increasing (or decreasing) in a given year due to a surplus (or deficit) of births over deaths, expressed as a percentage of the base population.

Replacement level fertility.—The level of fertility at which a cohort of women on the average are having only enough daughters to "replace" themselves in the population. By definition, replacement level is equal to a net reproduction rate of 1.00. The total fertility rate is also used to indicate replacement level fertility; in the United States today a TFR of 2.12 is considered to be replacement level. (See *zero population growth*).

Reproductive age.—See *childbearing years.*

Sex ratio.—The number of males per 100 females in a population.

Spermicide.—An agent that kills spermatazoa.

Stable population.—A population with an unchanging rate of growth and an unchanging age composition, because birth and death rates have remained constant over a sufficiently long period of time.

Stationary population.—A stable population with both a zero growth rate (because the birth rate equals the death rate) and an unchanging age composition.

Steroid hormones.—See *estrogen, progesterone.*

Survey.—A canvass of randomly selected persons or households in a population usually used to infer demographic characteristics or trends for a larger segment or all of the population. (See also *census.*)

Sympto-thermal method.—See *periodic abstinence methods.*

Total fertility rate (TFR).—The average number of children that would be born alive to a woman (or group of women) during her lifetime if she were to pass through her childbearing years conforming to the age-specific fertility rates of a given year.

Use effectiveness.—See *effectiveness.*

Vasectomy.—Surgical sterilization of a male by occlusion of the vas deferens.

Zero population growth.—A population in equilibrium, with a growth rate of zero, achieved when births plus immigration equal deaths plus emigration.

SOURCES: E. Grebenik and A. Hill, *International Demographic Terminology: Fertility, Family Planning and Nuptiality* (Liege, Belgium: International Union for the Scientific Study of Population, 1974), IUSSP Papers No. 4.

Arther Haupt and Thomas T. Kane, *Population Handbook* (Washington, D.C.: Population Reference Bureau, Inc., 1978).

Acronyms and Abbreviations

AID — Agency for International Development
AVS — Association for Voluntary Sterilization
BBT — Basal Body Temperature Method (See Glossary)
CBD — Community based distribution (of contraceptives)
CDB — Contraceptive Development Branch, CPR, NICHD
CPR — Center for Population Research, NICHD
CPS — Contraceptive Prevalence Survey
CRS — Commercial retail sales (of contraceptives)
DES — Diethylstilbestrol
DHHS — Department of Health and Human Services (formerly Health, Education and Welfare)
DMPA — Depo-Provera (See Glossary)
FAO — Food and Agriculture Organization
FDA — Food and Drug Administration
FPIA — Family Planning International Assistance
FSH — Follicle stimulating hormone
GNP — gross national product
IBRD — International Bank for Reconstruction and Development
ICCR — International Committee for Contraception Research, Population Council
IDA — International Development Association
IEC — Information, Education, and Communication
IEM — Information, Education, and Motivation (See China report, app. A)
IDRC — International Development Research Center
IFRP — International Fertility Research Program
ILO — International Labor Organization
IPPF — International Planned Parenthood Federation
IUD — Intrauterine device
IUSSP — International Union for the Scientific Study of Population
JHPIEGO — Johns Hopkins Program for International Education in Gynecology and Obstetrics
KAP — Knowledge, attitudes, and practice (of contraception)
LDC — Less developed country (See Glossary)
LH — Luteinizing hormone
LRF(LHRH) — Luteinizing hormone releasing factor (See Glossary)
MCH — Maternal and child health
MDC — More developed country (See Glossary)
MWRA — Married women of reproductive age
NDA — New Drug Application (FDA)
NFP — Natural family planning (See Glossary)
NGO — Nongovernmental organization
NICHD — National Institutes of Child Health and Human Development
NIH — National Institutes of Health
PARFR — Program for Applied Research on Fertility Regulation
PMA — Pharmaceutical Manufacturers Association
PIACT — Program for the Introduction and Adaptation of Contraceptive Technology
PRC — People's Republic of China
R&D — Research and development
TFR — Total fertility rate (See Glossary)
UN — United Nations
UNDP — United Nations Development Programme
UNFPA — United Nations Fund for Population Activities
WFS — World Fertility Survey
WHO — World Health Organization

Chapter 1

Summary, Issues, and Options

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Chapter 1

Summary, Issues, and Options

Overview

This assessment considers the probable impacts of specific fertility planning technologies on population growth. The influence of direct factors such as age at marriage and contraceptive use on population growth is relatively well understood. Less well understood are the indirect influences—the economic, sociocultural, religious, and political forces—that modify attitudes toward family size. Detailed examination of these indirect factors is beyond the scope of this study. Nevertheless, recognition of their importance in determining the use of fertility planning technologies underlies everything that follows.

The following pages examine the contribution of fertility planning technologies to reducing birth rates, improving maternal and child health, and enabling couples to choose the number and spacing of their children. They also explore future changes in contraceptive use and birth rates that might be possible. The strengths and weaknesses of present technologies and techniques are summarized, and the probable availability of new or improved technologies within the next 10 to 20 years is estimated. Also examined are how the U.S. Government supports international population asssistance, both through its international aid programs and through contraceptive research and development (R&D), and how the Food and Drug Administration's (FDA) regulatory role in assuring the safety and efficacy of drugs and medical devices affects U.S. international population assistance efforts. Finally, this report enumerates options that Congress might consider in the areas of reproductive research and contraceptive R&D and in furthering the aims of its international assistance programs, and highlights issues that could benefit from oversight hearings.

Introduction

Following World War II, the world experienced a sudden sustained drop in death rates which, combined with little change in birth rates, produced unprecedented growth in the world's population. Today, about 80 million people, the equivalent of an additional Mexico or Nigeria, are added to the planet every year.

More than 90 percent of this growth is in the developing world. In the United States and other more developed countries (MDCs), infant mortality is low and life expectancy exceeds 70 years, yet populations are stable or increasing only moderately because birth rates are low. In the less developed countries (LDCs), where infant mortality, although declining, is high, and life expectancy has not yet reached 55 years, birth rates remain high and populations are increasing, often at dramatic rates.

Rapid population growth in LDCs is a key factor in limiting the ability of these countries to raise their standards of living. Important obstacles to their socioeconomic development include limited resources, food distribution problems, high rates of debilitating disease and infant mortality, lack of proper sanitation, scarcity of investment capital, and shortages of educational facilities and work opportunities. But each of these barriers to a better quality of life in LDCs is intensified by the rapid pace of their population growth.

Because LDC governments that once dismissed rapid population growth as incidental to their well-being now actively seek help with their population problems, the United States and other MDCs provide population planning assistance as part of general developmental aid to countries who need and want help in reducing their birth rates. Such assistance has enabled many of these countries to achieve significant decreases in their population growth rates during the past decade, and there is now an international consensus that access to contraceptive services is a basic human right.

The issues examined here are not new to Congress. The United States has been a leader in world population issues since the early 1960's, when the Draper Commission recommended that the U.S. Government provide assistance for population planning, and the governments of a number of countries began to deal openly with what they saw as dangers in the sudden disparities between their birth and death rates. In its 1978 review, the House of Representatives through its Select Committee on Population issued a series of reports on population and developmental assistance, and identified areas requiring additional study. Foremost among these was the area of fertility planning technology.

Findings and conclusions

Fertility is declining in most LDCs, but population growth is continuing at high levels because of the momentum for future growth initiated by the high birth rates and rapidly falling infant mortality rates of the recent past. More than 1 billion people will be in their peak reproductive years (ages 15 to 29) during the next two decades.

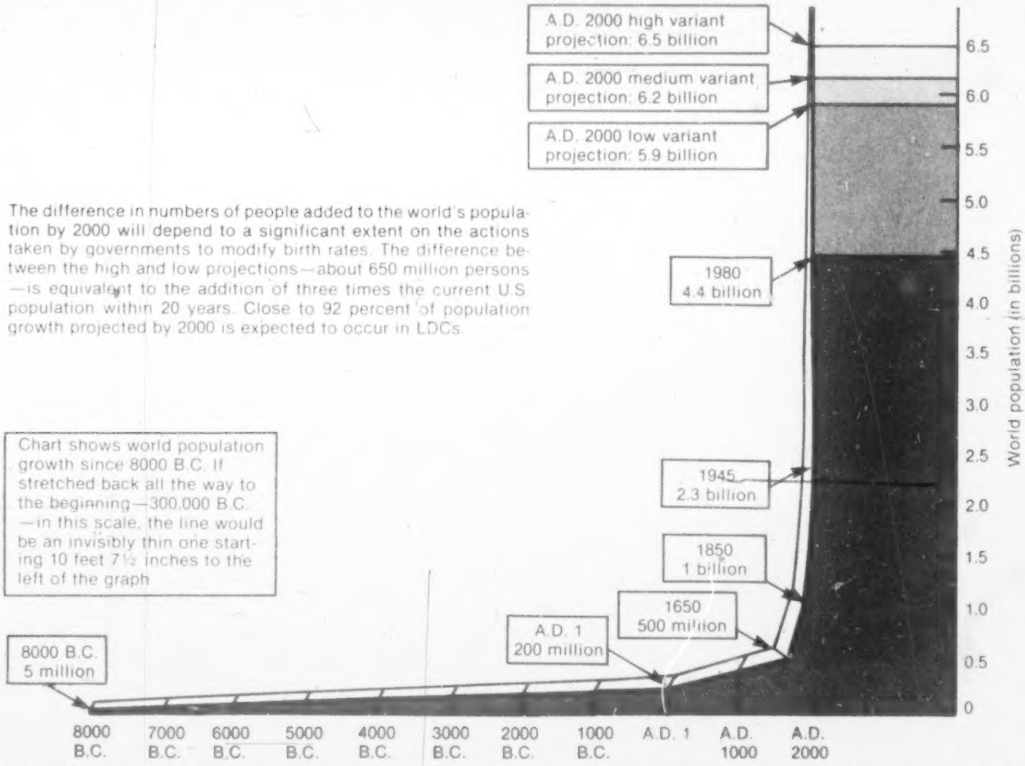
Even if growth rates continue their current decline, the world's population is expected to increase from 4.5 billion in 1981 to between 5.9 billion and 6.5 billion in the year 2000 (see fig. 1). Almost 92 percent of this growth will occur in LDCs. Growth will be greatest, according to current projections, in Africa (76 percent of the 1980 population added in 20 years), followed by Latin America (65 percent), and Asia (43 percent). But more of the increase in absolute numbers will occur in Asia (63 percent) than in Africa (22 percent) or in Latin America (15 percent), simply because many more people already live in Asia. Three-quarters of all LDC growth is expected to occur in just 18 countries: India, China, Brazil, Nigeria, Indonesia, Bangladesh, Pakistan, Mexico, Philippines, Thailand, Vietnam, Turkey, Iran, Egypt, Ethiopia, Burma, South Korea, and Zaire, listed here in the approximate order of the magnitude of their projected growth.

The striking momentum of world population growth means that the number of births expected each year will increase despite falling fertility rates, because the number of people in the reproductive ages (15 to 44) is increasing. The pyramid in figure 2A depicts the age structure that is typical of most LDCs, where populations are predominantly youthful because of high fertility and declining infant mortality during the past 20 years. If fertility rates were to fall rapidly, the lower groups of the pyramid (ages 0 to 4, 5 to 9, etc.) would begin to contain fewer individuals. The older ages (10 to 14, 15 to 19, etc.) would then form a "bulge," which would contribute a disproportionate number of people of reproductive age some 5 to 10 years later. This bulge is illustrated in figure 2B by the U.S. "Baby Boom:" members of this group are now of reproductive age and, although their fertility is thus far lower than that of their parents, the absolute size of this group is already resulting in an increase in the numbers of births per year in the United States.

The same cycle will take place in LDCs during the next 20 years, but on a more massive scale. Stationary population growth—the stabilization of deaths and births at near equal levels—would not be achieved until members of the largest age group (those now between 0 and 4 yeas) reach old age some 60 years from now. The age structure of a stationary population illustrated in figure 2A describes a typical MDC today.

Current declines in fertility are unevenly distributed among LDCs but many of those with the largest populations have achieved the greatest declines. China's birth rate has declined dramatically. Estimates of fertility decline between

Figure 1.—World Population Growth From 8000 B.C. to 2000 A.D.



The difference in numbers of people added to the world's population by 2000 will depend to a significant extent on the actions taken by governments to modify birth rates. The difference between the high and low projections—about 650 million persons —is equivalent to the addition of three times the current U.S population within 20 years. Close to 92 percent of population growth projected by 2000 is expected to occur in LDCs.

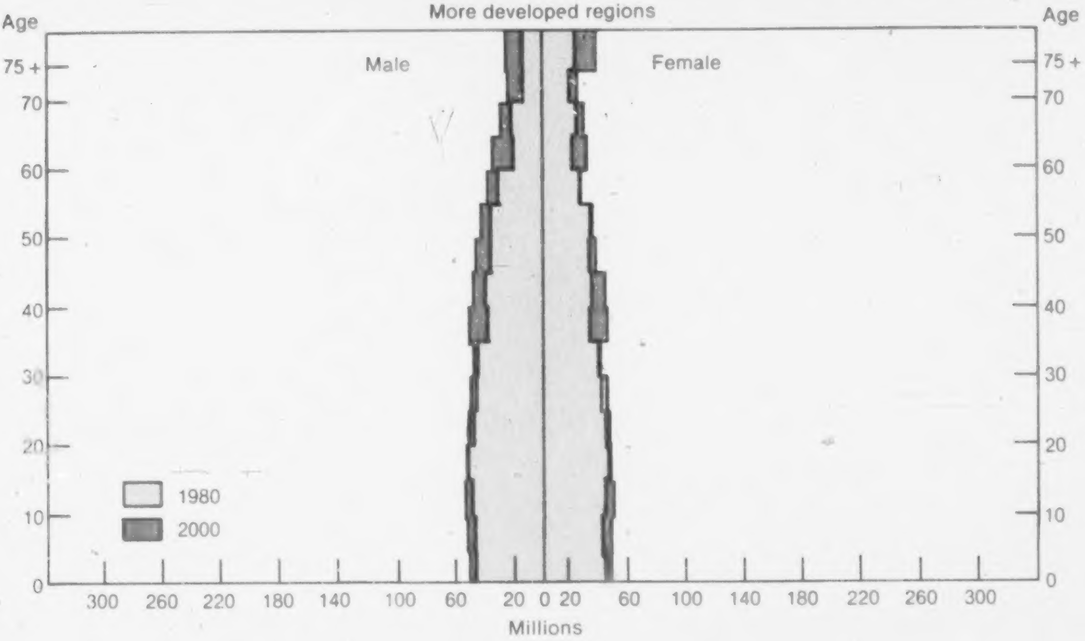
Chart shows world population growth since 8000 B.C. If stretched back all the way to the beginning—300,000 B.C. —in this scale, the line would be an invisibly thin one starting 10 feet 7½ inches to the left of the graph

SOURCE: United Nations, *World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment*, New York, 1979, projections 1980-2000; Arthur H. Westing, "A Note on How Many Humans Have Ever Lived," *Bioscience*, vol. 31, 1981; graph adapted from "Population Growth from 8000 B.C. to the Present," Oct. 6, 1981, © 1981 by the New York Times Co. Reprinted by permission.

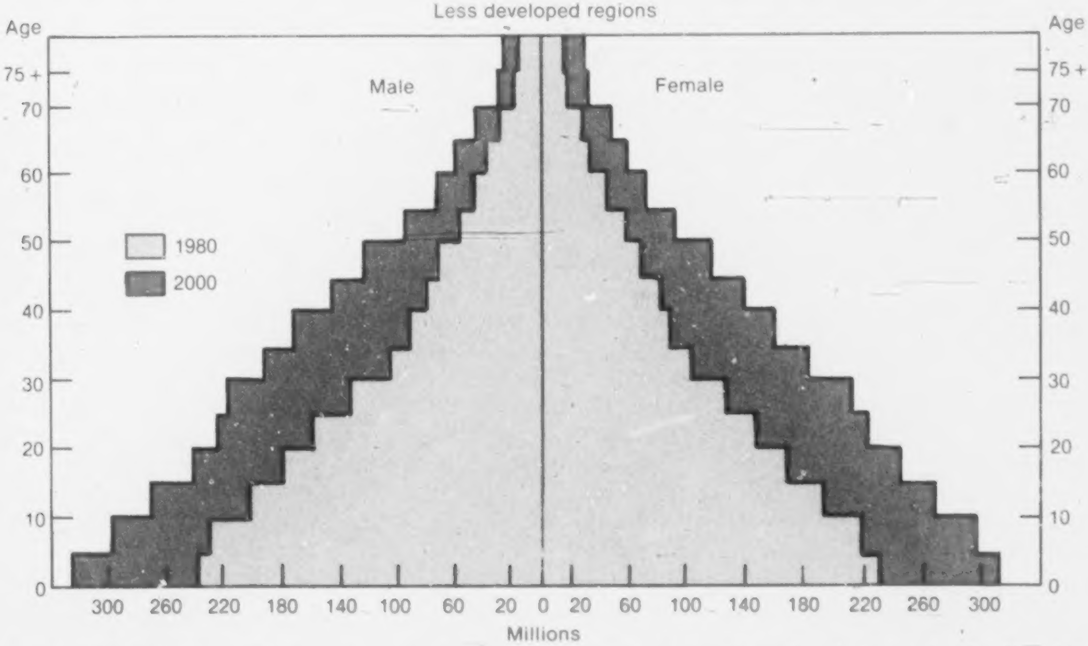
1965 and 1981 range from 17 to 58 percent. South Korea's fertility has fallen by 34 percent, Colombia's by 34 percent, and Thailand's by 36 percent during the same period (table 1).

Significant fertility declines are usually associated with some or all of the following conditions that involve government policy and action with regard to population programs (ordering does not imply relative importance): 1) governmental policies that encourage and promote equal status and opportunities for women, higher age at marriage, and more equitable distribution of wealth and educational opportunities, all of which lead to a higher standard of living; 2) programs designed to bring about a decline in infant mortality; 3) a government policy with explicit goals for reduction of birth or population growth rates; 4) a strong commitment to population planning by the country's leaders; 5) a family planning organizational structure with executive power to mobilize more than one government sector and to coordinate with the private sector; 6) population program funding (usually both external and internal sources); 7) provision of a broad range of contraceptive methods; 8) sufficient numbers of well-trained and motivated family planning program personnel; 9) population and family planning information, education, and communication (IEC) efforts that effectively reach all sectors of the population; and 10) direct or indirect incentives that encourage couples to limit the size of their families. The relative importance of these components is not known because country settings differ, and the nature of the country's developmental process and the level of certain key indicators (life expectancy, gross na-

Figure 2.—Age-Sex Composition of More Developed and Less Developed Regions, 1980 and 2000: Medium Series Projections



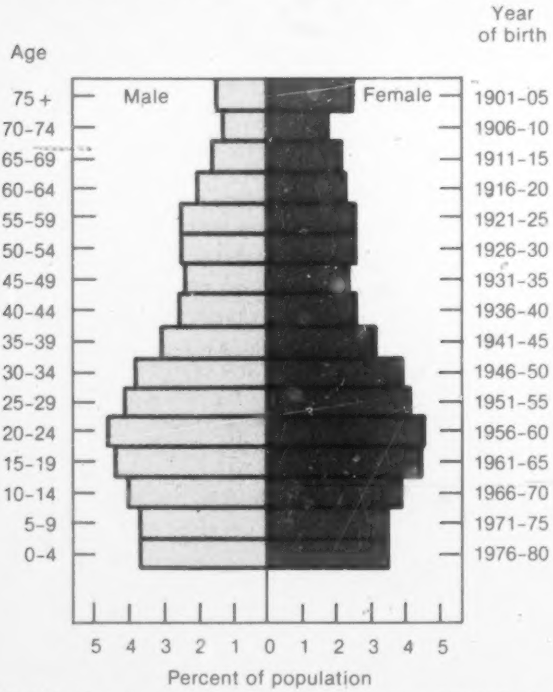
More developed regions



Less developed regions

SOURCE: U.S. Bureau of the Census, Illustrative Projections of World Populations to the 21st Century. Special Study Series, table 2, pt. B, p. 23, No. 79, January 1979.

Figure 2B.—Population Pyramid of the United States Illustrating the Effects of the Baby Boom



SOURCE: U.S. Bureau of the Census, Illustrative Projections of World Populations to the 21st Century, Special Study Series, p. 23, No. 79, table 2, pt. V, January 1979.

tional product (GNP), nonagricultural labor force participation, literacy rates, etc.) affect the extent to which a program can succeed in lowering fertility. But the degree of political will and commitment and the extent of administrative capacity play major roles in determining the magnitude of fertility decline.

Most people in the developing world live in countries that now consider their rates of population growth higher than desirable and want help in achieving lower rates. Recent experience has shown that growth rates can be slowed, often with startling success, despite the momentum inherent in LDC age structures. Although other development factors influence fertility, both stronger family planning programs and more effective, safer, and easier-to-use contraceptive methods can make important contributions to slowing population growth in the next two decades.

If governments decide to take actions to reduce population growth in addition to those actions currently planned, the world's population in 2000 will be closer to the lower estimate of 5.9 billion than to the upper estimate of 6.5 billion. Even the low projection, however, means that today's 4.5 billion world population will increase by 1.5 billion in just 20 years. For the longer term, additional efforts undertaken now can be still more decisive in terms of the number of people added to the world's population. The difference between the high and low projections for 2050 is 4 million people—a number nearly equal to today's global total.

Countries that wish to reduce their population growth rates have three options: raise mortality rates, encourage emigration (or discourage immigration), or reduce fertility rates. The first is morally untenable, and the second is not feasible over the long term because there are no countries left to accept vast numbers of immigrants. The only viable solution is to lower fertility rates. Many LDC governments have already decided to encourage this latter option; in the last 20 years, the proportion of the world's people who live in countries that provide support for family planning services has risen from about 10 percent to 90 percent.

Most LDCs face similar environmental and economic problems. In a number of these countries, the need to increase food and fuel production to keep pace with population growth has led to significant environmental degradation through denuding of forests, transformation of productive land into desert, and waterlogging and salinization of irrigated land. The large balance-of-payments deficits and increased debts confronting most oil-importing LDCs in recent years have depressed their rates of economic growth, lowering prospects for meeting basic health care needs, and making the provision of jobs a formidable task.

The collective effects of these continuing environmental and social problems, exacerbated by rapid population growth, have led to increased international migration and political instability. U.S. interests are directly involved, for example, in present immigration pressures

Table 1.—Percent Reductions in Crude Birth Rates From 1965 to 1981 for Selected Countries

	UN medium variant	Crude birth rates (births per 1,000 population)		
	Population (millions) 1981	1965	1981 (projected)	Percent reduction
Asia				
China[a]	969	30-40[b]	17-25[b]	17-58
India[a]	710	43	36	16
Indonesia[a]	155	46	35	24
Bangladesh[a]	91	50	46	—
Pakistan	85	48	44	—
Philippines[a]	53	44	34	23
Thailand[a]	49	44	28	36
South Korea[a]	39	35	23	34
Sri Lanka[a]	15	33	29	12
Malaysia[a]	14	42	31	26
Latin America				
Brazil	130	42	32	24
Mexico[a]	72	44	33	25
Colombia[a]	28	44	29	34
Venezuela	15	42	36	14
Chile[a]	11	33	22	33
Middle East				
Turkey	46	41	32	22
Egypt	43	42	41	—
Tunisia[a]	7	45	33	27
Africa				
Nigeria	80	50	50	—
Zaire	29	47	46	—
Tanzania	19	51	46	10
Kenya	17	50	53	—
MDCs				
United States	224	19	16	16
Japan	117	19	14	26
United Kingdom	56	18	13	28
France	54	18	14	22

— Slight fertility reduction, but data for trend measurement are not precise enough to warrant attaching a number.

[a] Signifies strong to moderate family planning program effort. Not all countries with strong to moderate programs included.

[b] China crude birth rate figures represent a range of estimates provided by National Academy of Sciences and U.S. Census Bureau. Official Chinese estimates of current birth rates are lower; see Chen report on China, app. A.

SOURCES: U.N., 1979-*World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment* for 1981 and 2000 population figures; Population Reference Bureau *1981 World Population Data Sheet*.

from Mexico, the Caribbean, South America, and Southeast Asia.

Rapid population growth is an intensifier of current environmental, food, energy, and resource pressures in LDCs, and its interaction with these problems is generating a new category of national security concerns. The implications of this interaction for national security, a term that is itself changing, remain largely unexplored.

Direct fertility determinants

Aside from indirect influences such as levels of socioeconomic development, education, and family size preferences, four factors have a direct and important impact on the number of births that will occur in the next 20 years: age at marriage, prevalence of breastfeeding, prevalence of induced abortion, and—the most significant—use of contraception.

Young age at marriage and near universality of marriage in the absence of widespread contraceptive use are important causes of high birth rates in many countries. In Europe and the United States, reductions in the proportion married and increases in age at marriage have historically helped reduce growth rates. In many LDCs, high infant, child, and adult mortality in association with the social stigma attached to illegitimate births has necessitated very young age at marriage and maximum reproduction to ensure survival of the family lineage. Increases in age at marriage have contributed to fertility decline in many LDCs in recent years and may continue to do so in such areas as the Asian subcontinent, where age at marriage remains low.

Breastfeeding delays the return of ovulation after childbirth, sometimes for as long as a year or more. If large numbers of women breastfeed for long periods, a natural form of birth-spacing occurs that can cause a modest reduction in overall fertility rates. But breastfeeding is an important influence on fertility only in societies with high fertility rates. Breastfeeding is an imperfect individual contraceptive because the amount of protection against pregnancy that it confers is extremely variable. In LDCs, fewer women are now choosing to breastfeed, and many women are breastfeeding for shorter lengths of time.

The limitations of current contraceptive technologies and lack of access to their use cause many women in all parts of the world to seek induced abortion to terminate unwanted pregnancies. Induced abortion is a medically safe procedure when performed early in pregnancy by skilled personnel. But the risk of maternal death or serious complications increases greatly when it is performed by less skilled personnel in marginal facilities and when it is performed later in pregnancy. Rates of induced abortion are high in LDCs, even though its legal use is constrained in some countries by religious beliefs. It is rarely a preferred method of fertility planning, but is resorted to when other means are not available, or fail.

Of all the means available, contraceptive use is by far the most important in lowering fertility. On average, women are fecund (capable of bearing children) from age 15 to 45, about 30 years. In the absence of contraception and allowing for time spent pregnant and infertile (due to infertility following birth or to breastfeeding), and time not spent in union because of divorce or widowhood, a woman could expect to have an average of about 10 children. If reduction of fertility rates to those associated with population stabilization (about 2.2 births to each woman) is desired, it is necessary that some method of contraception be used for up to 25 years.

The major methods of contraception currently in use are:

- Sterilization—vasectomy in the male, and tubal ligation/occlusion in the female.
- Steroid hormones—combined (estrogen and progestin) or low dose progestin oral pills, or intramuscular, long-acting progestin injections. These synthetic steroids are given in different combinations and different doses, depending on the commercial product, but they act primarily by inhibiting ovulation through suppression of the hypothalamic hormones that stimulate the release of follicle stimulating hormone (FSH) and luteinizing hormone (LH) from the anterior pituitary. The synthetic steroids also cause endometrial changes that make the uterus inappropriate for implantation should breakthrough ovulation and fertilization occur. Other changes that contribute to the contraceptive effect include scant and thick cervical mucus, reduced sperm transport and penetration into the uterus, and altered sperm and ovum transport within the fallopian tubes.
- Intrauterine devices (IUDs)—the insertion of a foreign body, made either of an inert substance or impregnated with other materials (copper, progesterone). Although the IUD prevents implantation in some mammals, its mode of action is unknown in the human being. There are several possible modes of action, from interference with sperm transport, to interference with ovum transport, to interference with implantation in the uterus. There is also some evidence that IUDs lead to increased sperm

damage and affect the motility of the ovum in the fallopian tube.

- Barrier devices—the condom for the male and the diaphragm and cervical cap for the female.
- Vaginal spermicides—high viscosity fluids that both kill sperm and block them from entering the cervical canal.
- Coitus interruptus—male withdrawal prior to ejaculation.
- Periodic abstinence (rhythm, natural family planning)—timed to avoid coitus near the day of ovulation.
- Postcoital douches—water or spermicidal solutions that flush out and kill sperm in the vagina.

The effectiveness and order of effectiveness of these methods in MDCs are listed in table 2.

Between now and the end of the century, more than 20 new or significantly improved technologies for contraception are expected to become available. The most likely candidates are identified in table 3. Highly likely to be available by 1990 are:

- Steroid hormones: safer oral contraceptives, improved long-acting steroid injections, and two new methods of administration—steroid implants (e.g., capsules in the forearm) and steroid vaginal rings.
- IUDs: three improved types are anticipated. Improved versions of the copper-releasing IUD will be effective longer than current IUDs. Advanced versions of the progestin-releasing IUD may be as effective as the pill and require replacement only every 5 to 10 years. Postpartum IUDs, which can be safely inserted immediately following delivery without excessively high expulsion rates, will make IUDs available to large numbers

Table 2.—Theoretical and Use Effectiveness of Various Means of Contraception (by pregnancies per 100 woman-years in MDCs)

Method	Theoretical effectiveness	Use effectiveness Range	Use effectiveness Average
Sterilization:			
Tubal	—	—	0.06
Vasectomy	—	—	0.15
Steroidal contraceptives:			
Injectable progestins (3-month regimen of medroxyprogesterone acetate)	0.24	—	0.24
Orals	0.1	0.2-4.5	0.7
IUDs:			
Lippes loop	1.9	—	2.7
Copper T	—	—	2.2
Diaphragm and jelly	3	3.3-33.6	12
Condom	3	6-30	12
Aerosol foam	3	3.0-35	14
Jelly or cream	4	2.0-45	20
Coitus interruptus	8	10-38	18
Periodic abstinence	2.5	5-40	20
Suppositories	14	17-27	22
Douche	18	21-40.8	35

SOURCES: R. G. Wheeler, G. W. Duncan, and J. Speidel, *Intrauterine Devices — Development, Evaluation, and Program Implementation*, Academic Press, 1974.
L. Liskin, "Periodic Abstinence: How Well Do New Approaches Work?" Population Information Program, The Johns Hopkins University, Baltimore, Md., September 1981.

Table 3.—Future Fertility Planning Technologies

Highly likely before 1990

1. Safer oral contraceptives
2. Improved IUDs
3. Improved barrier contraceptives for women
4. Improved long-acting steroid injections
5. Improved ovulation-detection methods for use with periodic abstinence
6. Steroid implants
7. Steroid vaginal rings
8. LRF-analog contraceptives for women
9. Prostaglandin analogs for self-administered induction of menses

Possible by 1990 but prospects doubtful

1. Monthly steroid-based contraceptive pill
2. Improved monthly steroid injection
3. New types of drug releasing IUDs
4. Mini-dose vaginal rings
5. Antipregnancy vaccine for women
6. Improved barrier contraceptives for men
7. Sperm suppression contraceptives for men
8. Reversible female sterilization
9. Simplified female sterilization techniques
10. Simplified male sterilization techniques
11. LRF analogs for self-administered induction of menses

Unlikely by 1990 but possible by 2000

1. Antifertility vaccine for men
2. Antisperm drugs for men
3. Antisperm maturation drugs for men
4. Lactation-linked oral contraceptives for women
5. Ovulation prediction methods for use with periodic abstinence
6. New types of antiovulation contraceptive drugs for women
7. Contraceptive drugs for women that disrupt ovum transport
8. Reversible male sterilization
9. Pharmacologic or immunologic sterilization for women
10. Pharmacologic or immunologic sterilization for men
11. Agents other than LRF analogs for self-administered induction of menses

SOURCE: Office of Technology Assessment Survey; S. B. Schearer and M. K. Harper, 1980.

of women in LDCs who otherwise might lack access to the medical personnel needed for insertion of other types of IUDs.

- Barrier devices for women: one-size-fits-all diaphragms, disposable diaphragms, spermicide-impregnated diaphragms, vaginal films, vaginal sponges, vaginal rings that release spermicides, and cervical caps that can be left in place for weeks or months.
- Improved ovulation-detection procedures for use with periodic abstinence methods: a wide variety of biological and biochemical parameters are altered when a woman ovulates, and researchers are endeavoring to improve or simplify the physical tests that a woman can use herself to determine when she ovulates. Improved methods of evaluating changes in cervical mucus, hormones in urine or saliva, and basal body temperature would enable greater numbers of users of periodic abstinence to know with certainty when they could safely engage in sexual intercourse during the second half of the menstrual cycle without risk of pregnancy, although the prediction of ovulation is likely to remain problematic.*
- New hormonal methods: methods that would reversibly inhibit ovulation using synthesized agonists or antagonists to one of the hormones that controls ovulation, luteinizing-releasing factor (LRF).
- Drugs that induce menstruation: prostaglandin analogs that depend on uterine muscle contraction for their action. Administered as vaginal suppositories, these drugs can also induce abortion during the first 8 weeks of pregnancy in about 90 percent of cases.

Most R&D on contraceptives has been conducted by MDC governments and the pharmaceutical industry. Prior to 1967, contraceptive R&D was financed largely through the private sector. In the 1970's, however, of funds spent worldwide on reproductive research and contraceptive development, private industry provided about 10 percent, and governments and philanthropic and nonprofit organizations provided 90 percent. The U.S. Government is the major current funder of research on improved contraception, providing nearly 60 percent of worldwide expenditures. Approximately 70 percent of worldwide funds go to basic research, 20 to 25 percent to contraceptive development, and less than 10 percent to safety evaluation.

The market approval process of the FDA affects population planning assistance, because the U.S. Food, Drug, and Cosmetic Act prohibits pharmaceutical manufacturers from exporting drugs for uses not approved for marketing in the United States. This policy is based primarily on the premise that one standard of drug approval is necessary, and under this premise, the United States would be promoting a double standard if it exported drugs not approved for use in the United States.

The FDA approval process for all drugs averages 7.5 years. FDA requirements for the specific types of tests and test animals to be used in providing safety and efficacy data for contraceptives usually make the average length of the approval process for contraceptive drugs longer than for other drugs by about a year. The reason for these more stringent testing requirements for contraceptive drugs over other classes of drugs is that contraceptives are given to young, healthy individuals and can potentially be administered over a period of 30 years, whereas other drugs are usually used to treat diseases and/or are often administered only for a few weeks at most.

Drug patents run for 17 years, but effective patent life is shortened by the regulatory process. For oral contraceptives, however, shortened patent life has not affected the original manufacturers' abilities to retain a large share of the market even when prices were increased after the patent period had expired.

But expanding product liability has escalated costs and made the prediction of future costs uncertain for both the pharmaceutical industry and its insurers. As in the case of patent life, these difficulties are being experienced by all drugs (and products in general), but the contraceptive market has been especially affected by product liability problems.

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*Such methods would also benefit couples with infertility problems by pinpointing the fertile period.

Rising product liability costs and the ability of manufacturers to retain their market share even after patents expire signify higher prices for contraceptives and reduced purchasing power for family planning programs.

International population assistance

International population assistance evolved in response to growing awareness of the problems that accompany rapid population growth and to requests from LDC governments for technical assistance in addressing these problems. The purposes for which population assistance funds are expended include: 1) development of population planning policies appropriate to the recipient country; 2) contraceptive commodities; 3) systems for contraceptive distribution and use; 4) information, education, and communication activities; 5) research on the delivery of family planning services, on the development and application of improved or new contraceptive methods, on the social, economic, and cultural conditions that affect their acceptance and use, and on those social conditions that directly affect birth rates (e.g., age at marriage); and 6) the gathering, evaluation, analysis, and dissemination of demographic and other information.

Less than 2 percent of official development assistance from all MDC donors is currently allocated to population activities, a proportion that represents a small decline since 1970. The United States provides just under 4 percent of its total development assistance for international population activities.

In 1980, total resources (excluding China) committed to population and family planning programs in LDCs amounted to about $1.0 billion. Of this total, LDC contributions accounted for about $450 million, private sources about $100 million, and MDC sources about $450 million.* Donor governments (including the United States) are the principal source of MDC assistance; funds are channeled: 1) through nongovernmental organizations (NGOs) such as the International Planned Parenthood Federation (IPPF) and Family Planning International Assistance (FPIA); 2) directly to LDC governments (bilateral assistance); and 3) through multilateral organizations such as the United Nations Fund for Population Activities (UNFPA). Private sector donors channel money primarily through NGOs such as IPPF. MDC and private contributions arrive in LDCs as money, contraceptives, information, and technical assistance in developing and administering family planning programs and in collecting and analyzing population data. Agencies administering the largest amounts of population assistance are the U.S. Agency for International Development (AID), UNFPA, and IPPF (fig. 3).

The United States supports population assistance through two main channels, AID (Office of Population) and the World Bank. The World Bank receives moneys in the form of general development appropriations, about 1 percent of which are directed toward population projects. AID, in turn, channels funds bilaterally to LDC governments, multilaterally to UNFPA, and through private intermediary organizations, such as IPPF, FPIA, etc. World Bank support is exclusively loan assistance; AID programs are largely grant assistance but include some loans as well.

The Foreign Assistance Act states that the population planning component is "to increase the opportunities and motivation for family planning and to reduce the rate of population growth." It authorizes the President "to furnish assistance . . . for voluntary population planning. In addition to the provision of family planning information and service and the conduct of directly relevant demographic research, population planning programs shall emphasize motivation for small families."

In recent years this has been translated by AID into program expenditures of about 50 percent for family planning services, 15 percent for institutional development and training, 10 percent for information and education, 10 percent for biomedical and operations research, 10 percent for demographic analysis, and 5 percent for policy development and research into factors that increase the use and acceptance of family planning services.

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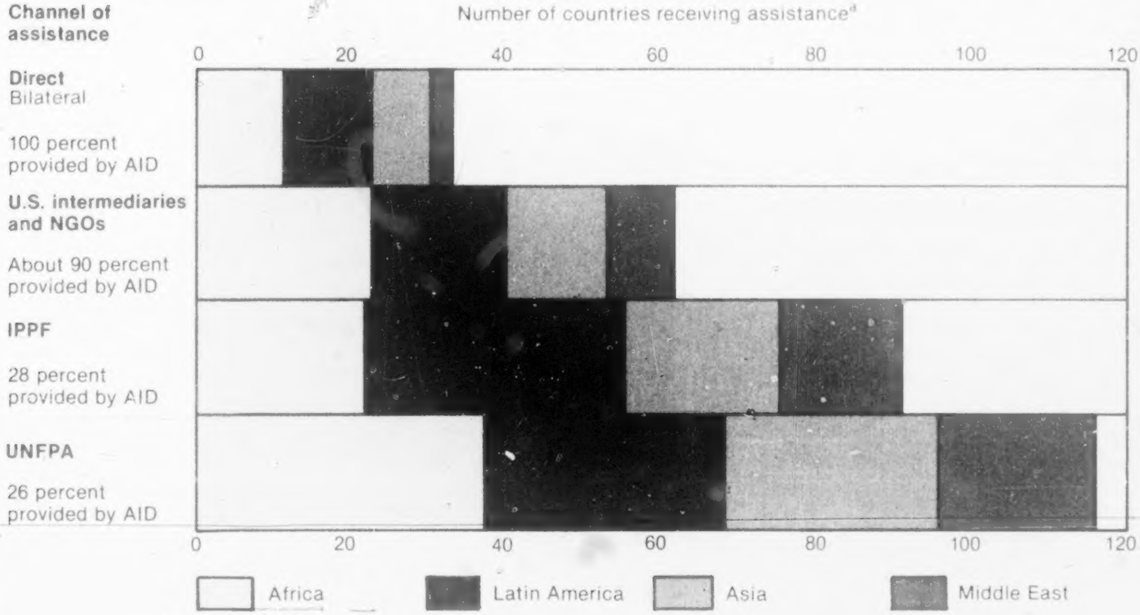
*China's expenditures in 1980 for its intensive birth planning campaign are estimated to have approached $1.0 billion; see app. A.

Figure 3.—Channels Through Which AID Population Assistance Arrives in LDCs, 1979



[a]Some countries receive population assistance from more than one source.

SOURCE: UNFPA, Report on Population Assistance, 1979

In fiscal year 1979, AID bilateral assistance totaling $48 million went to 33 LDC governments. NGOs such as FPIA, Association for Voluntary Sterilization (AVS), International Statistical Institute (World Fertility Survey), Population Council, International Fertility Research Program (IFRP), etc., channeled an additional $90 million from AID into technical assistance to 64 LDCs. Multilateral assistance totaling $30 million from AID went to UNFPA (26 percent of UNFPA's budget), which UNFPA in turn granted to 116 LDCs. IPPF channeled $22 million of AID funds (28 percent of its budget) to private IPPF affiliates in 88 LDCs. (The usual funding level is about $12 million; this $22 million included forward funding to alleviate IPPF cash flow problems and the fiscal year 1980 appropriation was reduced accordingly. Thus the United States, in population assistance as in other developmental programs, provides both special assistance to nations with whom it has a close relationships and a share of the multilateral international support that goes in some measure to virtually every LDC (fig. 3).

The amount of U.S. population assistance channeled through AID rose from $5 million in 1965 to $185 million in fiscal year 1979. This figure remained constant in 1980 and increased to $190 million in 1981 through continuing resolutions. The 1982 appropriation has been increased to $211 million; the authorization for fiscal year 1983 is $230 million.

Although the United States continues to provide the most population assistance to LDCs, its proportion of the total amount has decreased over the last 14 years. The United States provided 50 percent or more of all primary source assistance until 1974, when this proportion leveled off to about 40 percent, where it has remained. This decrease is largely due to increased contributions from other MDC donors, including the Scandinavian countries, Japan, and West Germany. In addition, the impact of inflation cut the 1981 funding level, in constant dollars, to $41 million below that of the peak year of 1972 ($121 million). The 1982 appropriation is $28 million below the amount required to maintain the 1972 level.

International population programs

Population assistance has had diverse impacts, including a heightened awareness of the problems associated with rapid growth. Government officials, scientists, and informed lay people in LDCs and MDCs are working together to develop, test, and disseminate new contraceptive methods. Many women of reproductive age in LDCs have at least heard of family planning even though some may not fully understand what it means or may not yet have convenient access to contraceptive methods. More data of better quality are available to enable governments to formulate policy, set demographic goals, and monitor program effectiveness. Each of three decennial census rounds from the 1960's to the present has been characterized by substantial improvements in data collection techniques and data processing and analysis capabilities in LDCs. The World Fertility Survey and Contraceptive Prevalence Surveys are providing important data on fertility trends and differentials, levels of contraceptive knowledge and use, and program evaluation. Operations research projects are testing innovative approaches to the delivery of fertility planning information and methods. Social marketing programs have put contraceptives on the road to being self-financing in some LDCs. And the mass media campaigns associated with social marketing programs have played a major role in enhancing public awareness and acceptability of family planning.

The need for greater sensitivity to and knowledge of the role of the sociocultural factors that motivate people to adopt family planning is clear. Social settings that allow women few options beyond raising large numbers of children, and negative attitudes of peer groups, relatives, and spouses can be important constraints to contraceptive use. Thus population and development programs that are multifaceted and address relevant social, economic, and health needs along with delivery of family planning services are most likely to be successful.

Family planning programs contribute significantly to improved health of women and children and have made a substantial difference in accelerating the rate at which fertility declines, as shown in table 1. (The countries noted with asterisks in table 1 are those that have strong-to-moderate family planning programs efforts.) In countries with strong family planning efforts for which data are available, fertility declined an average of 30 percent between 1965 and 1975. This compares with declines of about 4 percent in similar countries with weak family planning programs and 2 percent in countries with no programs. On balance, about 15 to 20 percent of the declines in fertility between 1965 and 1975 in 94 LDCs is attributable to the family planning component of population program effort. Thus, although family planning programs are not the only factors at work in countries experiencing substantial fertility declines, such programs clearly make a difference.

The use of contraceptive technologies can substantially lower birth rates, but their availability and acceptability vary. Delivery systems may be inadequate or culturally inappropriate so that family planning services are in fact not effectively available. The contraceptive methods used in a particular country may not be the ones preferred but the ones available. People may become dissatisfied and discontinue the methods used because of side effects, the need for repeated application, costs, medical contraindications, contraceptive failure, and concerns about long-term safety. A realistic goal is for each country to have enough technologies appropriate for local conditions so that each individual has access to at least one method that meets his or her current needs. Improved and new technologies could enhance family planning effectiveness and efficiency by reducing side effects, permitting easier administration, and simplifying delivery system requirements.

At present, of 374 million couples of reproductive age in LDCs (excluding China), some one-fifth, or about 74 million, are using contraception. By 2000, there will be at least 638 million couples of reproductive age (889 million couples if China is included). Because about 80 percent of these couples would need to use some form of contraception if fertility were to approach replacement levels, the number of couples practicing family planning regularly and consistently would have to increase about sevenfold in the next 20 to 30 years.

Program costs per user currently range from $6 to $100 annually in LDCs, for an average of about $15 per user for an efficient family planning program (one that combines public and private sectors, provides access to voluntary sterilization, includes IEC activities, demographic data collection and analysis, and adequate infrastructure support). In order to increase current contraceptive use to the 80 percent of all couples of reproductive age necessary to approach replacement fertility levels, 300 million LDC couples (excluding China) would now have to be practicing contraception. Although contraceptive use is not expected to exceed 50 percent by 2000, if it were to reach the 80-percent level it would require, using the $15 cost per user per year, a minimum total international population support budget of $4.5 billion annually, including the contributions of LDCs. (This figure excludes China; PRC expenditure data are estimated in app. A.) Using the same assumptions of cost per use, and using 1980 dollars, the rise in numbers of couples in the reproductive ages would increase this cost to about $7.4 billion in the year 2000. (Under this formula, the amount rises to $10.7 billion when China's childbearing-age population is added.)

Program emphasis will shift in coming years as LDC needs change. More emphasis will be given to innovative approaches to the delivery of services to rural populations. Programs will need to rely more heavily on private sector delivery system development in order to become self-supporting. Family planning programs will be integrated with other components of development. Decentralized approaches that identify and meet community-level needs and that focus on primary health care and capitalize on local institutions will be more prevalent. The need for well-trained and highly skilled managers will be crucial as the demand for services grows. More emphasis will have to be placed on increasing work opportunities for women in all sectors of development, including family planning programs.

Effective use of present and new technologies will be a high priority. Program managers will have to allocate resources to ensure adequate distribution, storage, and back-up medical services. The effective communication of information on fertility planning technologies will be of central importance in allowing couples to choose family planning methods appropriate to their current needs. As countries move to self-financing, more will establish their own facilities for contraceptive manufacture. Since new or improved fertility planning technologies are more likely to be developed in MDCs, efforts to enable LDCs to readily import these new technologies will need to be expanded. LDCs may also want to enter into special import-export arrangements that will permit sale of fertility planning technologies among themselves.

Because LDCs consider the slowing of their population growth an urgent need and the lead time required to make new contraceptive methods available is relatively long, the methods that should be emphasized in the next decade are those already in hand and those that will become available in the next few years. Experience with family planning programs in LDCs indicates that if commitment is strong, if delivery systems are adequate and culturally acceptable, and if a broad range of methods is made available, the pace of fertility reduction can be enhanced. Although imperfect, currently available contraceptive methods can provide the basis for fertility reduction, but further biomedical research is critical to improving the safety, efficacy, and acceptance of contraceptives.

For policymakers concerned with modifying population growth, the most meaningful population information is the difference in numbers of people added to the world's population if governments do or do not take feasible actions to reduce birth rates in addition to those already under way. The actual amount attributable to additional governmental actions that reduce birth rates is neither accurately known nor explicitly stated by most demographic experts who make projections. There is general agreement, however, that if governments intensify current actions to reduce growth rates, the low variant projection is more likely to be achieved. The total difference between the high and low variants is sizable—650 million persons—and is equivalent to the addition of three times the current United States population in just 20 years.

Issues and options

The breadth of purpose of international population assistance, the range of its activities, and the variety of U.S. governmental involvement in these activities result in many issues of congressional interest. Not all of these issues require legislative action, and many can be examined through the congressional oversight process. In this section, the principal issues and related legislative options for: 1) Federal involvement in contraceptive R&D, and 2) international population assistance support are addressed.

In the biomedical research area, the issues center on the U.S. Government's key role in support of reproductive and contraceptive R&D and on reconciling how the United States regulates the drugs and medical devices industries with the need to diffuse these technologies to countries that may have different risks or perceptions of risks.

Contraceptive technologies

The U.S. Government's role in the development and dissemination of contraceptive technologies is mediated through two avenues: 1) the R&D activities of the National Institutes of Health and AID; and 2) the regulatory policies of FDA. Peripheral to contraceptive technologies, but possibly affecting them, are U.S. patent laws and their interrelationships with FDA's regulatory process and the direction that product liability legal doctrines have taken in the United States.

THE ROLE OF THE U.S. GOVERNMENT IN CONTRACEPTIVE R&D

The Federal Government not only supports contraceptive R&D, but also regulates the drug and medical devices industries through FDA's market approval process in which efficacy and safety requirements must be met. The development and dissemination of contraceptive technologies thus can be influenced through Federal funding of contraceptive R&D, and through governmental actions that could stimulate or restrain expanded or renewed interest in contraceptive products by private industry.

ISSUE: Federal support of contraceptive R&D

In 1979, governmental agencies throughout the world provided approximately 80 percent of funding for reproductive research and contraceptive development. The United States provided nearly 60 percent of all funds, or about $89 million. Approximately 70 percent of worldwide expenditures were devoted to basic research, training, and institutional support; about 23 percent to contraceptive development; and approximately 7 percent to evaluation of current methods.

Federal support is provided by the Contraceptive Development Branch of the National Institutes of Child Health and Human Development's (NICHD) Center for Population Research and, to a lesser extent, by AID. AID is a major funder of the Program for Applied Research on Fertility Regulation (PARFR) and the International Fertility Research Program (IFRP). Federal funds are also provided indirectly through AID's contribution to the International Committee for Contraceptive Research (ICCR), to the UNFPA, and the Program for the Introduction and Adaptation of Contraceptive Technology (PIACT).

OPTIONS:

A. *Sustain financial support of R&D at current levels.*

If Congress continues to judge that governmental action is warranted to continue the development of improved contraceptives for use at home and abroad, the minimum action would be to sustain support of existing programs at current levels. Although the dollar amount for reproductive research and contraceptive development increased from $80 million in 1972 to $112 million in 1979, inflation has meant, in terms of constant dollars, a cut of about 20 percent from the 1972 funding level.

With limited research dollars, individual investigator-initiated research that may not be part of a larger program might have higher priority and be more likely to be funded than large, goal-oriented, contract research of the type needed for stimulating contraceptive development.

B. Substantially increase financial support.

Arguments for increases in contraceptive research include the following: Present contraceptive development programs may develop many useful new and improved contraceptives over the course of the next two decades if additional money is available. Because many LDCs are actively pursuing policies to reduce population growth and there is increasing concern in MDCs about the side effects of current fertility planning methods, there is a strong need for improved contraceptive methods both in the United States and abroad. The potential impact is enormous in terms of improved family planning effectiveness, reductions in numbers of unwanted pregnancies and induced abortions, improved maternal and family health, alleviation of human suffering, and opportunities for economic progress. Without such added investments, emergence of many new contraceptive products is likely to be either prevented or very substantially delayed.

Congress can authorize and appropriate more funds for the entire field of reproductive research, using the presently available funding channels, NICHD and AID. This action could strengthen this field in a balanced, comprehensive fashion and thereby increase scientific prospects for discovery and development of improved contraceptives in the future.

Alternatively, Congress may wish to increase funding only for contraceptive development. Added investments in this specific area are highly likely to produce payoffs in the form of useful new technologies. As total public funding for such development is currently less than $20 million annually, present funding levels could be significantly increased at relatively low cost. An additional $20 million annually in this specific field could have a substantial impact.

The budget of AID's Office of Population also could be augmented and earmarked or recommended for contraceptive development—which would enable AID to increase funding for both the three U.S.-based international contraceptive development programs and other groups that could contribute to this endeavor.

Increases in NICHD's budget would need to be earmarked for the Contraceptive Development Branch. Such action would greatly increase the volume of goal-oriented R&D being conducted under contract by NICHD. This action would contribute directly to the development of new contraceptives for U.S. use and indirectly to the work of international programs seeking to develop and introduce new contraceptives in LDCs.

C. Reduce financial support.

Although it could be argued that industry invests little in contraceptive R&D because government funds are available, and that one impact of this option would thus be increased industry participation, such factors as product liability are major deterrents to greater industrial participation in contraceptive R&D. For basic reproductive research, the additional factors of longer time for return on investment and greater risk further deter industrial participation in fundamental research.

For government research, reduction or elimination of Federal funding for basic research and contraceptive R&D would produce different effects depending on how the reductions were carried out.

A reduction exclusively in NICHD's budget would rapidly result in a discontinuation of research by many U.S. research centers now working in this field under NICHD support. Much of the Nation's safety research on contraceptive methods currently in use would also be eliminated. At least initially, the direct effect on the U.S.-based contraceptive development programs to which AID contributes (IFRP, PARFR, and ICCR) would be minimal, as they are not funded by NICHD. But because these other programs utilize basic research and goal-oriented research findings that emerge from NICHD-funded projects, over the long term their prospects for successful development of new methods could be reduced significantly.

A reduction exclusively in AID's contraceptive development program likely would be detrimental for at least three of the four nongovernmental contraceptive development and dissemination programs. Three programs—IFRP, PARFR, and ICCR—are highly dependent on AID funding, and any substantial reductions in their budgets would essentially put them out of business. While PIACT might continue its work independently if its budget were maintained under such circumstances, it could not replace the clinical research and applied R&D work of the other three organizations as PIACT concentrates largely on providing product information to LDCs.

STIMULATE THE INTEREST OF PRIVATE INDUSTRY IN CONTRACEPTIVE R&D

Most of the numerous factors that might stimulate more private industry interest in contraceptive R&D concern removing apparent disincentives against developing and marketing of contraceptive products. But as these factors also involve major issues in their own right, trying to change these factors to promote contraceptive R&D quickly impinges on other substantial interests. Hence, although options for some factors are discussed here, it should be kept in mind that the effects of these changes would reach beyond contraceptives to other drugs and other products.

ISSUE 1: Product Liability and the Contraceptive Industry

According to representatives of companies actively researching new contraceptive products, product liability is as great a negative factor in making a business decision regarding new contraceptives as meeting the FDA requirements for safety and efficacy.

The primary effect on a manufacturer from product liability is financial; i.e., compensation for claimants and defense of claims. A secondary effect is the adverse publicity accruing to the product and its manufacturer. Because of increasing frequency of claims and escalating size of successful judgments against contraceptive manufacturers, pricing of liability insurance has become so uncertain that insurers are either withdrawing from the field, mandating that manufacturers self-insure larger and larger amounts of first-dollar costs, or placing contraceptive drugs and devices in special categories of risk separate from product liability insurance for the manufacturer's other products.

As liability costs are business expenses that are incorporated into the price of the affected product, manufacturers may be increasingly reluctant to devote research and development efforts to products such as IUDs. Once the sale is made, there is less opportunity to recoup liability costs, as sales are not as frequent and continuous as they would be for oral contraceptives. With the latter, liability costs can be passed on, which may explain in part the large price increases of oral contraceptives (discussed next) in comparison with other drugs. Thus, product liability may be affecting not only the propensity of private industry to develop new contraceptives but also the kinds of contraceptives to be developed in the future.

Because the product liability problem is of concern for products in general, the contraceptive field may well be an inappropriate forum for congressional consideration of this larger liability issue. But recognition by the Congress of liability problems with contraceptives might encourage the congressional committees that have jurisdiction over laws governing commercial products to consider changes in these laws.

ISSUE 2: Effective Patent Life

The current process through which drugs and medical devices are cleared for commercial distribution and sales takes a number of years. However, in order to protect its interest in the potential new product, a company must apply for and be granted a patent long before the product has been approved by FDA. Drug patents run for 17 years, but it takes an average of 8.5 years for a contraceptive drug to clear the regulatory process, cutting its effective patent life to less than 9 years. Whether this situation inhibits the development of new drugs and medical devices is not clear.

Wyeth Laboratories and Ortho Pharmaceutical share approximately 70 to 80 percent of the U.S. market for oral contraceptives. Wyeth's patent on norgestrel is still in effect, but the patent on norethindrone expired in 1973. Since the patent expiration, only Mead-Johnson and Lederle have entered the market, and Lederle no longer markets its oral contraceptive. No generics (nonbrand name drugs) have entered the market. The Pharmaceutical Manufacturers Association also reported in August 1980 that oral contraceptives had the greatest price increases of all classes of pharmaceuticals in the periods 1969 to 1979 (187 percent) and 1978 to 1979 (23.7 percent), as compared to only a 37.4 percent increase in price during 1969 to 1979 and a 6.5 percent increase in 1978 to 1979 for a sample of over 1,000 drugs. Although other factors (e.g., product liability) may be at work, shortened patent life has not had a significant effect on the oral contraceptive market. After patents have expired, prices have remained high and new firms have not been able to enter the market on a competitive basis.

ISSUE 3: Export of Non-FDA Approved Drugs

The market for U.S. manufacturers of contraceptives could be expanded if the law on the export of non-FDA approved drugs were changed.

Current law prohibits the export of drugs for uses that are prohibited in the United States. Two categories of drugs are at issue: 1) drugs unevaluated for use; and 2) drugs evaluated but not approved for use. There are some exceptions to the drug exportation ban: e.g., investigational drugs can be exported for investigational purposes, provided that the importing country's government has approved such imports. In addition, medical devices not approved for marketing in the United States can be exported if: 1) they conform to the laws and specifications of the importing country; and 2) their export is not considered by the Secretary of Health and Human Services to be contrary to the public health and safety of the importing country.

Changes in the export provision of non-FDA approved drugs have been considered by Congress. In the 96th Congress a bill adopting the medical devices export law for drugs was passed by the Senate but died in the House of Representatives.

OPTIONS

A. Keep the status quo, where drugs not approved for marketing in the United States cannot be exported to other countries but medical devices can be exported under certain conditions.

By keeping the status quo, Congress prevents the foreign marketing of drugs that have not been adequately tested or whose safety has not been established by U.S. standards.

Current law does not affect the foreign production and use of contraceptives that are not approved for use in the United States. For example, medroxyprogesterone acetate (Depo-Provera) is manufactured and used as a contraceptive abroad, although approved only for the treatment of endometrial and renal cancer in the United States.

Keeping the status quo helps to avoid the danger of "unsafe" drugs being manufactured in the United States and then "dumped" on other countries as some critics have charged. Existing law protects the United States from being criticized for subjecting other people to risks to which it does not allow U.S. citizens to be exposed.

However, the relative risks and benefits of a drug are not the same for people in LDCs, where health conditions, including the risks of pregnancy and childbearing, are quite different from those in the United States. Further, the wide range of contraceptives available to U.S. women may not be available to women in LDCs, a factor that affects the risk/benefit assessment of a particular contraceptive. Thus, the United States may be depriving women in LDCs of drugs that would have a greater benefit than risk for them.

B. Adopt the medical devices export law for drugs.

As in the case of medical devices, non-FDA approved drugs could be exported, provided that the specifications and laws of the importing country were met, and the Secretary of HHS determined that the importing country's public health and safety were not compromised.

C. Adopt the medical devices export law for drugs, and add one or more of the following provisions:

1. Require that the risk/benefit analysis for an unapproved drug take into consideration conditions of the drug's use (and other health risks) to individuals in the importing country

This provision is based on the assumption that the risks and benefits of a given drug can change from country to country. Some advocates of this provision believe that a risk/benefit analysis of a drug should be based on data actually obtained in the importing country and in response to requests from that country. Determination of a drug's benefits would be based on the prevalence and severity of the target medical condition, and safety assessments could consider such items as the extent to which the drug user could be monitored for adverse reactions. Other user conditions—e.g., nutritional status—that could affect a drug's safety and efficacy could also be studied.

Instead of actually collecting data from clinical trials conducted in the importing country, it may be more feasible to adjust data collected from other countries to reflect user conditions and disease prevalences in the importing country. It is very difficult to collect data from a sufficient number of women within any given country when low-incidence, but very important, medical events are to be assessed. Many importing countries would lack the capacity to conduct such assessments.

2. Establish industrial standards of conduct.

Procedures could be developed in which officials—and perhaps the public—in importing countries could be informed of the risks, benefits, and costs of the drugs they wish to import. Written verification of such an informed consent process, signed jointly by company executives and importing country officials, could be filed with the Secretary of Health and Human Services (HHS). Violation of that document could serve as a basis for withdrawal of approval.

D. Develop international standard-setting mechanisms on the use, safety, and effectiveness of contraceptive drugs and devices.

If modifications of existing export laws on drugs along the lines of the current medical devices export law (options 2 and 3) are adopted, such international standards would be helpful to the Secretary of HHS in determining whether or not the importing country's public health and safety are compromised.

WHO could be encouraged to develop international standards for safety and efficacy and/or for labeling and promotion standards for contraceptive drugs and devices. These standards —in conjunction with safety data specific to the importing country—could provide the basis for the Secretary's decision.

INTERNATIONAL POPULATION ASSISTANCE

Because the momentum for large increases in the world's population is clearly present and recognized, many LDCs now actively seek population assistance. They recognize the implications of their high growth rates, and their requests for population assistance have risen to the point that donor agencies can meet only a fraction of current requests for such aid. Further, the people who will contribute to the anticipated surge in world population gorwth in the next few decades have already been born (see fig. 2A), and a very substantial increase in the use of fertility planning methods is required in LDCs in order to slow population growth.

There are two issues to be addressed in U.S. international population assistance efforts—level of funding, and the distribution channels through which U.S. funds are dispensed.

ISSUE 1: Level of Funding

Because there are many competing demands on Federal funds, careful examination of the impact of various funding levels is essential.

OPTIONS:

A. Reduce financial support.

Reduced support from the United States for population programs would force LDCs to reduce their programs, cut back on supplies that require foreign exchange, eliminate training programs, and probably decrease program outreach to rural and other hard-to-reach areas. Because the momentum for population growth already exists, spending for population programs deferred now would still be necessary at higher funding levels because of inflation, loss of trained personnel, and duplication of start-up costs. The capability of LDCs to finance their own family planning programs through such promising avenues as commercial retail sales (CRS) programs would be postponed. (CRS programs provide oral contraceptives, condoms, and spermicides at low cost and can effectively extend to hard-to-reach areas. However, they require substantial initial funding for bulk procurement of contraceptives, subsidizing of retail prices, and technical assistance in the establishment of backup medical services.) Also, if the U.S. level of support were to be decreased now, self-sufficiency of LDCs in population planning and progress in economic development might be further delayed, resulting in: 1) deteriorating social and economic conditions including increased death rates in LDCs; 2) need for significant future increases in general economic developmental assistance from MDCs to LDCs; or 3) if the United States were to abstain from future increases in economic developmental assistance, widening of the economic chasm between MDCs and LDCs, with all of the political implications that are associated with these differences.

Overall, U.S. cuts would disrupt the current working balance among private organizations, intergovernmental agencies, and government donors, with particularly adverse effect on the private agencies that are likely to suffer major reductions yet are often the most cost effective. Under current budgets, AID and the multilateral donors cannot meet current commitments. With further cuts, many countries and agencies would have to reconsider their ability to implement effective programs.

The U.S. Government, as the largest single donor to international population assistance, has been able, to some degree, to coordinate population assistance efforts and influence the direction of funding. A reduction in population assistance funds would reduce U.S. influence on program strategies and design.

B. Increase financial support.

Population and family planning programs have been a key factor in recent fertility declines. The needs of many LDCs for population assistance and the current shortfall of funds for these purposes are well-documented.

Congress has in fact increased its appropriation from $190 million in fiscal year 1981 to $211 million in 1982; $230 million has been authorized for 1983. These current and potential increases represent a significant step and underscore the importance of population assistance at a time when many high priority social programs are being cut. However, inflation has reduced the purchasing power of these funds to below that of the total amount provided for population funding in the peak year of 1972 ($121 million, or about $239 million in 1982 dollars). At a time of rising requests for assistance, the AID population commitment is decreasing in purchasing power.

AID's fiscal 1982 budget is about $200 million below levels of documented need and insufficient to the point that: 1) most AID-supported projects and programs will receive less than the funds needed to satisfy demand for family planning services or otherwise function optimally (this includes inability to meet shortfalls at UNFPA, IPPF, and other major private voluntary organizations); 2) there will be few new initiatives in Africa (where governments are now beginning to ask for assistance) and the Near East; and 3) projects are being terminated prematurely, before recipient countries become self-sufficient.

UNFPA's 1982 calendar year budget of $135 million represents a shortfall of $40 million to $100 million.[*] The $40 million represents the

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[*] On the basis of its 1979-80 projections of 15 percent per year growth in contributions from MDC donors, UNFPA set up multiyear commitments for various LDC and international programs, both new and ongoing. As 1980-81 unfolded, a plateau in the U.S. contribution occurred, and the U.S. dollar strengthened in foreign markets, making other currencies relatively weaker. These events combined with inflation to give MDC donations less actual value

(Footnote continued on p. 22)

gap between available funds and established needs for ongoing programs and commitments previously made. The $100 million includes new programs that have been requested and merit funding, but for which funds are not available. However, a much larger number of countries now wish populaiton assistance, and there has been a 20 percent increase in couples of childbearing age in LDCs since 1972. This argues for an even greater increase in assistance commitments in the coming years.

Excluding China, only 20 percent of couples of reproductive age are currently using contraception in LDCs. Efficient programs cost an average of $15 per user annually (new programs can cost as much as $100 per user). Many countries are only beginning to implement family planning programs so start-up costs are very high. If fertility is to fall to replacement levels, contraceptives must be used by about 80 percent of couples in the childbearing ages. The growth in the population, the need for increased use of fertility planning methods, and higher costs of programs that cannot be fully implemented until LDCs themselves can contribute more support all argue for major incremental increases in population assistance in the coming years.

One approach to steady incremental increases in funding would be to meet the recommendation of the International Conference of Parliamentarians on Population and Development held in Colombo, Sri Lanka in 1979. Delegates representing 58 countries unanimously called for a total annual allocation of $1 billion in international population assistance (exclusive of LDC commitments) by 1984.

More recently, at the International Conference on Family Planning in the 1980's held in April 1981 in Jakarta, Indonesia, participants from 76 African, Asian (including China), Latin American, and Middle Eastern countries joined representatives of major international agencies in calling for a rapid increase in overall national and international expenditures for population and family planning programs to $3 billion annually. LDC representatives stressed the urgency of reducing high fertility rates, slowing the momentum for further growth, raising women's status and economic opportunities, and providing family planning services as a basic human right.

Assuming that the United States wishes to maintain its 40 percent share of the total assistance budget and that other MDCs and private sources increase their contributions, the goals set by these international representatives might be attained, although the timing is likely to be delayed. If the United States were to increase its contributions by 30 percent per year (assuming an annual inflation rate of 15 percent), its contributions could keep pace with inflation and incremental funding would be available for increasing needs. The United States would thereby maintain its leadership position in population assistance and would contribute significantly to meeting requests from LDCs for assistance with a problem most of these countries now view as high priority.

ISSUE 2: Distribution of Population Assistance Funds.

Present channels and content of population assistance programs reflect both the priorities of the assistance agencies and the needs of

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than numerical value. An approximate shortfall of $10 million to $15 million resulted from exchange rate fluctuations due to the increasing value of the dollar. Current program commitments to between 55 and 60 programs, when added to reasonable extensions of existing programs, yield, at a minimal estimate, a shortfall of some $40 million per year for the next several years. (This shortfall could be as high as $100 million in total value in requests for both 1-year and multiyear projects that merit funding but which UNFPA cannot meet.) As a result, UNFPA's governing council has asked the organization to assess and evaluate each of its programs in order to see where cuts can be made, but has used the assumption that there will be a 10 percent increase in contributions in the next few years. If contributions do rise at this rate, if programs are reviewed and realigned, and costs can be reduced by extending multiyear programs to cover additional years, UNFPA could meet its commitments. The total annual UNFPA budget required to meet commitments after realigning and reassessing would rise from the 1980-81 total of $132 million to at least $146 million in 1981-82.

LDCs. A change in the present distribution system would affect the type of aid available and hence would have different impacts on different regions.

Because of differences among regions, varying approaches are required. In general, Asia's primary needs are for efficient and effective services delivery to very large rural populations, a large volume of supplies, and additional training in health care and program management.

In Latin America, some governments are reluctant in the face of religious and conservative opposition to give rigorous support to family planning programs, but public demand for family planning services is growing rapidly. As a consequence, support for private agencies and expansion of family planning within health care systems are increasing.

In the Middle East, the limitation of opportunities beyond childbearing for women is a major barrier to fertility change. Expansion of government and private services, and of broad social programs, is needed. The continuation of innovative efforts by private population and family planning agencies to change perceptions of the role of women is crucial.

Birth rates in some countries in Africa are the highest in the world, but few African countries have formulated policies that make a direct connection between their serious economic and social problems and rapid population growth. As most of these countries do, however, favor the provision of family planning services in the context of maternal and child health activities, emphasis should be on support for family planning as a component of health programs. Improved collection and analysis of demographic and other data would make an important contribution to increased understanding of the magnitude of population growth and its impact on economic development and the environment. Expansion of the role of existing private voluntary agencies would facilitate delivery of family planning services and improvements in maternal and child health.

There is thus a major difference between Asia, for example, where governmental programs are established but where support is needed to make them comprehensive and effective, and Africa, where there is much less appreciation of the implications of rapid population growth and less governmental commitment to extend family planning services widely.

However, these broad generalizations mask the variability that exists among countries, which is at least as great as that among regions. Different countries have different cultural values and development goals and thus require different forms of assistance. Different forms of government and different political alliances also make some forms of assistance more appropriate to one country than another.

Technical assistance and commodities for population planning and family planning programs are currently channeled through several major international agencies and many private nongovernmental agencies. The largest agencies, AID, UNFPA, IPPF, and the World Bank provide technical assistance in varying degrees in the areas of family planning services (including commodities); information, education, and communication; institutions and training; research and evaluation; policy development; and data collection.

Each agency tends to have different emphases and priorities within a broad range of support activities. For example, UNFPA provides technical assistance for basic population data collection, and channels assistance for family planning services primarily through health ministries incorporated into maternal and child health programs. AID is the largest supplier of commodities and places strong emphasis on family planning services delivery. IPPF emphasizes family planning services delivery in private sector clinic settings. Because each agency has different emphases and countries have different priorities, the agencies can cooperatively tailor their support to individual country needs.

About 28 percent of AID funds are currently dispensed to the multilateral agencies (UNFPA and IPPF), 26 percent are dispensed bilaterally, and 46 percent dispensed to and through private intermediaries and organizations. Changes in present proportions of assistance would have uncertain effects on the balance that has been achieved among these agencies and there are no compelling reasons for considering changes at this time. Given current shortfalls, duplication of efforts is not an issue, but if funds are increased, efforts to promote greater coordination among agencies at administrative and country levels would need to be examined more closely.

Additional issues for congressional oversight

Several additional issues that Congress may wish to consider for oversight are as follows:

- Although population issues are the jurisdiction of several congressional committees, there is no single congressional mechanism for continued oversight of international population assistance. A prime issue, therefore, is whether population growth in LDCs and its implications for their progress toward economic self-sufficiency should continue to be addressed within the general subject of international economic developmental assistance, or whether a committee or subcommittee should be formed to focus directly on issues related to national, regional, and world population growth.
- Present criteria for determining which countries receive population assistance are established by AID, except for the following provisions: limitation of assistance to the poorest countries (currently interpreted as yearly income below approximately $300 per capita), prohibition of aid to Communist bloc countries, and prohibition of funding of abortion services. A review of Congress's legislative guidelines and tne ways in which AID has interpreted them would be a necessary corollary of changing the current levels of funding and of the current apportioning of aid between multilateral and other channels through which assistance is funneled.
- As summarized earlier in looking at the differences among Asia, Latin America, the Middle East, and Africa, the pace of population change in different regions of the world varies greatly. Each region requires different types of assistance and runs on different timetables, and in some settings immediate results cannot be expected. Priorities and restrictions in addressing these various aspects of global population growth require clarification. For example, current restrictions prohibit aid to China. The result of this action toward the country which contributes the largest proportion of global growth may be that U.S. population assistance is oriented less toward having the greatest impact on total world population growth than to slowing population growth in those regions of the world and in those countries where the United States has a strong interest. Congress may want more extensive reviews of these priorities and the reasons behind them.
- If governmental support for social programs, including economic aid to LDCs, is reduced, there will be a need to accelerate the pace of self-sufficiency of LDCs, and for additional support from the private sector in both LDCs and MDCs. Congress may therefore wish to explore the extent to which this support can be encouraged, and how governmental actions can facilitate greater activity by the private sector in LDCs.
- Factors that may be inhibiting the development, manufacturing, and marketing of medical products—e.g., product liability suits, shortened patent life, and FDA's export provisions on drugs—are not unique to the contraceptive market, but are representative of problems that have arisen generally for all types of consumer products. Addressing these generic consumer product problems through the issue of fertility planning technology may be inappropriate, but

some resolution of these generic problems will eventually have to be made. Thus, Congress might want to address these general issues through those committees tht have jurisdiction over product liability, patent laws, and the FDA's regulatory processes.

Chapter 2

Population Growth to the Year 2000

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Chapter 2

Population Growth to the Year 2000

Abstract

Rapidly declining death rates combined with continuing high birth rates are producing unprecedented world population growth, some 92 percent of which is occurring in less developed countries (LDCs). The current world population of 4.4 billion is projected to reach about 6.2 billion (range: 5.9 billion to 6.5 billion) in 2000. Eighty million people are being added to the world annually; this number is expected to rise to 95 million per year by 2000 (range: 70 million to 120 million). Growth will be greatest in Africa, Latin America, and Asia. Three quarters of this growth is expected to take place in 18 countries (listed by the magnitude of their projected growth): India, China, Brazil, Nigeria, Indonesia, Bangladesh, Pakistan, Mexico, Philippines, Thailand, Vietnam, Turkey, Iran, Egypt, Ethiopia, Burma, South Africa, and Zaire. At current rates of growth, many LDCs will double their populations within 25 years. The difference between the low and high projections for the year 2000 is roughly three times the size of the current U.S. population. The United States is expected to grow from today's 226 million to 260 million in 2000, and 290 million in 2050, but to fall from 4.9 percent of the world's population today to 4.0 percent in 2000, and 3.5 percent in 2050. The impact of global population growth on the United States will thus be greatest from beyond its borders.

The demographic transition from high to low birth rates experienced earlier by more developed countries (MDCs) is taking place in LDCs under very different conditions: death rates have declined at a more rapid pace; LDCs have far greater momentum of population growth because large proportions of their populations are reaching reproductive age; international migration can no longer serve as an outlet for rapidly growing populations; LDCs have more limited development opportunities than did MDCs in the past, and LDCs have higher levels of unemployment that were experienced earlier in MDCs. LDCs do have three major new advantages, however: many LDC governments are taking direct actions to reduce birth rates; highly effective fertility planning methods are now available; and the international transfer of appropriate knowledge and technology is now organized.

Trends in population growth

The fundamental cause of today's rapid population growth is becoming widely known: death rates have declined rapidly while birth rates have continued at high levels. The overwhelming proportion of this growth is taking place in the developing world. Birth rates have begun to edge downward in these countries, but declines in death rates have been dramatic.

The downward trend of birth and death rates in developing countries follows a path traveled earlier and much more slowly by the industrial-

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ized nations. This historic transition from high to low rates, which began in western Europe some 200 years ago, combined with the industrial revolution to sharply divide the world into one-quarter rich and three-quarters poor. A number of terms—more and less developed; developed and developing; North and South; First, Second, and Third Worlds; industrialized and underdeveloped—describe this division. This report uses those terms most commonly used by international agencies: more developed countries and less developed countries.

Although the dichotomy is real, the terms oversimplify. The two groups of nations are vastly different in terms of income, health, education, and rates of natural increase, but differences within each group are also wide, as shown in tables 4 and 5. Awareness of the heterogeneity and individuality of LDCs is vital to understanding their levels of development and population growth.

Table 4.—Selected Population Data for the 25 Most Populous LDCs

Country	(Medium variant) population (millions) 1981	2000	1981 rate of natural increase	1981 doubling time[a]
China	969	1,190	0.8	59
India	710	1,040	2.1	33
Indonesia	155	221	2.0	35
Brazil	130	212	2.4	29
Bangladesh	91	153	2.6	27
Pakistan	85	145	2.8	25
Nigeria	80	149	3.2	22
Mexico	72	132	2.5	28
Vietnam	54	79	2.8	25
Philippines	53	83	2.4	29
Thailand	49	76	2.0	35
Turkey	46	69	2.2	32
Egypt	43	65	3.0	23
Iran	39	65	3.0	23
South Korea	39	51	1.7	41
Burma	36	55	2.4	29
Ethiopia	33	55	2.5	28
South Africa	30	48	2.4	29
Zaire	29	46	2.8	25
Colombia	28	42	2.3	33
Argentina	27	33	1.6	43
Afghanistan	23	37	2.7	26
Morocco	21	36	3.0	23
Algeria	19	36	3.2	22
Sudan	19	31	3.1	22
All LDCs	3,357	4,926	2.1	34
All MDCs	1,138	1,272	0.6	113
World	4,495	6,199	1.7	41

[a] Number of years to double population (at current growth rate).

SOURCE: *U.N., 1979 World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment* for 1981 and 2000 population figures; Population Reference Bureau *1981 World Population Data Sheet* for rate of natural increase and doubling time figures.

Table 5.—Selected Socioeconomic and Quality of Life Indicators for the 25 Most Populous LDCs and Selected MDCs

Country	1978 GNP (dollars)	1975 adult literacy rate (percent)	1981 life expectancy (years)	1981 infant mortality[a]
China	230	NA	68	56
India	180	36	52	134
Indonesia	360	62	50	91
Brazil	1,570	76	64	84
Bangladesh	90	26	47	139
Pakistan	230	21	52	142
Nigeria	560	NA	48	157
Mexico	1,290	76	65	70
Vietnam	170	87	62	115
Philippines	510	87	61	65
Thailand	490	84	61	68
Turkey	1,210	60	61	125
Egypt	400	44	55	90
Iran	2,160[b]	50	58	112
South Korea	1,160	93	66	37
Burma	150	67	53	140
Ethiopia	120	10	39	178
South Africa	1,480	NA	60	97
Zaire	210	15	46	171
Colombia	850	81	62	77
Argentina	1,910	94	69	41
Afghanistan	240	12	42	185
Morocco	670	28	55	133
Algeria	1,260	37	56	127
Sudan	320	20	46	141
United States	9,590	99	74	13
Japan	7,280	99	76	8
United Kingdom	5,030	99	73	13
France	8,260	99	73	10

NA - Not available.

[a] Annual number of deaths to infants under 1 year of age per 1,000 live births.

[b] 1977 data.

SOURCES: World Bank, *World Development Report, 1980* (GNP and Literacy Rates; Population Reference Bureau, *Population Dynamics of the World - Map, April 1981* (Life Expectancy Rates); Population Reference Bureau, *1981 World Population Data Sheet*

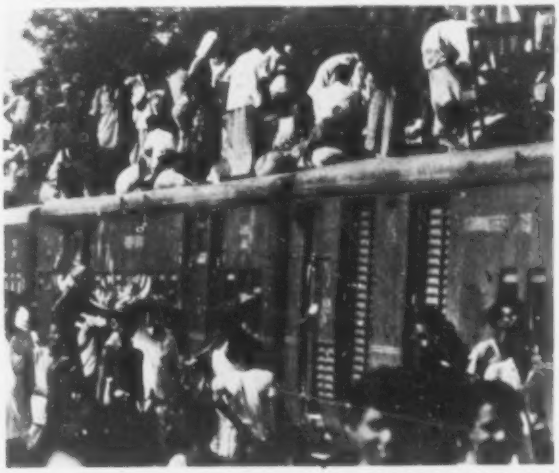


Photo credit: World Bank

Passengers board train in Dacca; LDC transportation systems are rarely underutilized

Following World War II the world experienced a sudden, sustained drop in deaths which, combined with little change in births, produced unprecedented growth in numbers of people. Today, about 80 million persons—the equivalent of an additional Mexico or Nigeria—are added to the planet every year (7). By the end of the century, despite reduced birth rates, this annual increase is expected to reach 95 million. Most of this increase in numbers is taking place in the LDCs, where expectations of a better life are also rising.

The timing, intensity, and effects of population changes have varied greatly among LDCs, but, beginning with India in the early 1950's, more than 40 percent of LDC governments have become concerned about their rapid growth and its detrimental impact on national development, and have sought means to reduce their birth rates.

Although the most immediate effect of rapid population growth in LDCs has been to limit their ability to raise living standards, the negative consequences of population growth are not confined to these countries. MDCs are increasingly concerned about their own population growth. The congressionally established Commission on Population Growth and the American Future concluded in 1972 that: "the stabilization of our population could contribute significantly to the Nation's ability to solve its problems." National assessments in Great Britain and Japan have reached similar conclusions. A few countries in Europe are worried about their slow population growth, but overall there is growing concern that world population is pushing against the Earth's carrying capacity. The Independent (Brandt) Commission on International Development (4) warned of the global consequences of population growth and its increasingly severe pressure on many basic resources.

The demographic transition

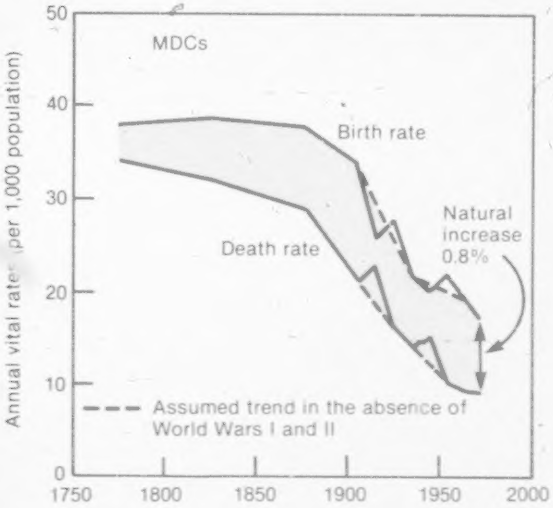
Although the timing of the transition from high to low birth and death rates varies among countries, the chronology of the phases is similar:

1. an early phase of rising growth as death rates fall and birth rates do not;
2. a peak growth phase as death rates continue to fall and birth rates begin to fall;
3. a falling growth phase as death rates stabilize at lower levels and birth rates continue to decline; and
4. a stabilization phase of low, nearly equal, death and birth rates. (See Tech. Note A, ch. 4)

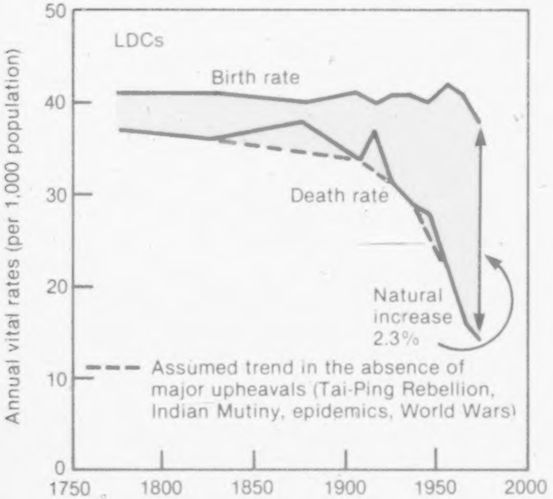
Differences in timing have produced much higher growth rates at the beginning of the transition in LDCs than those experienced by MDCs (fig. 4). Conditions in Africa, Asia, and Latin America today therefore differ from those of the MDC demographic transition in several very important ways:

- *Death rates declined much faster in LDCs than they did earlier in MDCs.* The decline in annual death rates from 30 to 15 per 1,000 population that took 150 years in Great Britain, Sweden, and the United States, took only about 35 years in India. Declines in LDC death rates from major causes such as cholera, malaria, and smallpox have been facilitated by new large-scale international transfers of health and agricultural technologies from MDCs.
- *As a result, population growth has been much more rapid in LDCs in both rates and absolute numbers than it was in MDCs.* Great Britain's growth rate fell slowly from 1.4 to 0.4 percent between 1800 and 1921; the annual increase in numbers did not deviate greatly from 200,000. By contrast, India's annual growth rate rose from about 1.5 to 2.5 percent between 1950 and 1970 as its annual increase in numbers soared from about 5 to 11 million in just 20 years.
- *LDCs have greater momentum of population growth built into their age structures than MDCs had earlier.* Sustained higher birth

Figure 4.—Comparisons of the Demographic Transition in LDCs and MDCs



In MDCs death rates declined slowly beginning in the late 18th century. Birth rates followed closely. Population growth rates rarely exceeded 1.5 percent per year.



In LDCs birth and death rates remained high through the first decades of the 20th century. Then death rates began to drop. Birth rates stayed high and populations grew at 2.5, 3.0, and 3.5 percent or higher a year. Since the mid-1960's some countries' birth rates have begun to decline.

SOURCE: State Department Bulletin, "The Silent Explosion," fall 1978.

rates have produced large proportions of children who will soon reach reproductive age. Thus, even if average family size is reduced dramatically in this generation, national birth rates will fall more slowly because such a large proportion of people are of reproductive age.

- *International migration can no longer serve as an outlet for rapidly growing populations as it did for much of Europe.* There are no more "empty" lands to colonize or to accept great numbers of immigrants. Nevertheless, population pressures in LDCs and income opportunities in MDCs are likely to result in sizable illegal migration and its attendant problems as long as rapid population growth in LDCs continues.
- *LDCs have far fewer opportunities for development than did MDCs.* Most LDCs have little unutilized arable land, are unevenly endowed with natural resources, and face stiff competition from MDCs in international markets for industrial products.
- *LDCs face higher levels of unemployment than were experienced earlier in MDCs.* The opportunities for employment (or migration) that were available earlier in MDCs are not available in LDCs, where unemployment and underemployment are widespread.

In sum, LDCs have not only encountered population growth unlike anything in MDC experience, but have fewer opportunities for accommodating this growth than were available to MDCs a century earlier. They do, however, have three major new developments in their favor:

1. *Many LDC governments, unlike MDCs earlier, are taking direct actions to reduce birth rates by utilizing new fertility planning technologies and by other means.* Although family planning programs vary greatly in effort and effects and most governments allocate less than 1 percent of governmental expenditures to them, more than 92 percent of the world's population live in countries whose governments provide some form of family planning services for their people. (See ch. 7.)

2. *There are more effective technologies for the planning of births than existed in 1800 or even 1950.* These technologies—the pill, IUD, and new voluntary sterilization techniques—have replaced less effective methods in MDCs and are beginning to be used in LDCs. (Technological development is now lagging, however: although concerted research efforts to develop better contraceptive technologies increased appreciably during the 1960's, financial support for such efforts has fallen in real purchasing power since 1970.) (See ch. 6.)
3. *International transfer of knowledge and technologies to reduce birth rates is now organized.* The proportion of total international development assistance devoted to population activities rose from virtually none in 1960 to 2 percent in 1979. MDCs now provide about $450 million annually for population assistance. (See ch. 9.)

This assessment focuses on policies of the U.S. Government now and during the next 20 years, which will be a pivotal period in global population history. LDCs receive greatest consideration because problems arising from rapid population growth are particularly acute in these countries and because their population growth between 1980 and 2000 will account for more than 90 percent of the rise in world numbers. How fertility can be changed takes precedence because it is the most viable option for countries that wish to lower population growth rates.

Projections of world population growth

The size of world population during the next 20 years can be predicted with greater certainty than most future events because about 60 percent of the people who will be on Earth in 2000 A.D. are already here, and—barring a possible global nuclear catastrophe or unexpected great epidemic or famine—experts differ little on how many will die in the coming two decades. The uncertainties lie in how many people will be born. Their numbers will depend to a great extent on what the LDCs do to modify their national birth rates. There is a consensus that population growth has such a powerful, built-in momentum that actions taken or not taken now will determine the size of world populations far into the future.

World population is projected to grow from an estimated 4.5 billion in mid-1981 to 6.2 billion (between 5.9 and 6.5 billion; much will depend upon the rates at which fertility declines) in mid-2000. Despite decreasing growth rates, the total number of persons added to the world's population each year is expected to increase from some 80 million in 1981 to about 95 million (between 70 and 120 million) in 2000. This growth will be distributed very unevenly among different regions and countries. Close to 92 percent is expected to occur in LDCs, cutting the MDC proportion of world population from 26 percent in 1980 to 21 percent in 2000 (and the U.S. proportion from 4.9 to 4.0 percent).

The LDCs differ greatly in population size and growth both by individual countries and by geographic regions. Growth will be greatest, according to current projections, in Africa (76 percent of the 1980 population added in 20 years), Latin America (65 percent), and Asia (43 percent). However, more of the increase in absolute numbers will occur in Asia (63 percent) than in Africa (22 percent) or in Latin America (15 percent), simply because many more people already live in Asia. Three-quarters of all 1980-2000 LDC growth is expected to occur in just 18 countries: India, China, Brazil, Nigeria, Indonesia, Bangladesh, Pakistan, Mexico, Philippines, Thailand, Vietnam, Turkey, Iran, Egypt, Ethiopia, Burma, South Africa, and Zaire, listed here by the magnitude of their projected growth. Much of future world population growth thus depends upon what happens in these few large countries.

The interval during which some of these countries will double their populations, if present fertility trends continue, is very brief: Kenya may double the numbers of its people in 18 years, India in 33, Bangladesh in 27, and Egypt in 23 (table 4). (See Tech. Note B.)

Sources and bases of population projections

The projections used here are those of the United Nations (U.N.), the principal source of information about world population. Its Population and Statistical Divisions publish current population, birth, and death data annually and prepare periodic global assessments and projections.

Projections based upon a 1978 assessment were published in 1979; revised projections based upon a 1980 assessment were published in 1981. The projections include high, medium, and low variants. The medium variant is designed to represent likely demographic trends based on past demographic changes, expected social and economic progress, ongoing government population policies, and prevailing public attitudes toward population issues. The high and low variants are intended to represent the effects of plausible variations in these factors.

The U.N. projections are similar to those produced by five other major sources (table 6). Each set of projections starts from estimated 1975 base populations, fertility rates, and life expectancies. Each uses similar assumptions about death rates and assumes no major wars, famines, or epidemics, and all except the U.N. exclude international migration. All depend on data from individual nations—sources whose frequency, accuracy, and completeness of information vary greatly. (See Tech. Note A.)

The projections prepared by the U.S. Bureau of the Census also include high, medium, and low series, and are based on current levels of fertility, development, and family planning; government policy on population matters; and experience in countries with similar social, economic, and political settings. These projections assume that fertility will decline more or less continuously throughout the period, that all

Table 6.—Alternative Projections of Population in 2000 (millions)

Region	Source U.S. Bureau of the Census 1980	United Nations 1979	World Bank 1979	University of Chicago (6) 1977	Harvard University (5) 1977	Population Council[c] 1981
World:						
High	6,520	6,508	—	5,974	—	6,353
Medium	6,175	6,199	6,004	5,883	5,882	—
Low	5,799	5,855	—	5,752	—	6,046
MDCs						
High	1,324	1,319	—	1,266	—	1,135
Medium	1,272	1,272	1,261[a]	1,263	1,275[a]	—
Low	1,225	1,229	—	1,250	—	1,054
LDCs						
High	5,196	5,189	—	4,706	—	5,218
Medium	4,903	4,926	4,743	4,620	4,607	—
Low	4,574	4,626	—	4,501	—	4,992
China:						
High	1,425	1,228	—	1,135	—	—
Medium	1,284	1,189	1,210[b]	1,131	1,129	NA
Low	1,141	1,132	—	1,109	—	—
India						
High	995	1,105	—	971	—	—
Medium	959	1,037	973	951	1,009	NA
Low	922	983	—	923	—	—

NA = Not available

[a] Excluding temperate South America.

[b] Including Taiwan, as the others do.

[c] SOURCE: T. Frejka, and P. W. Mauldin, unpublished manuscript, November 1980.

SOURCE: Office of Technology Assessment

countries will have adopted some kind of family planning program by 2000, and that the effectiveness and coverage of such programs will increase.

The World Bank's single population projection was prepared by estimating, for each country, the year in which fertility would reach replacement level. For all countries except those in sub-Saharan Africa, fertility decline toward the replacement level is assumed to have started in 1975 if not before. For the sub-Saharan countries, the declines are expected to begin in 1980-85.

The University of Chicago projections also include high, medium, and low variants. The projected fertility rates are based on specified relationships between the rate of fertility decline and the strength of family planning efforts. The high projection assumes that each country maintains its present level of family planning effort. The medium projection assumes that strong family planning efforts eventually are implemented in all nations by the year 2000. The low projection assumes that all countries have strong family planning programs by 1995.

The Harvard University projections assume that fertility will decline to replacement levels by 1990-95 in MDCs and by 2000-05 in LDCs. The Population Council projections assume attainment of replacement level fertility at varying times from 1980-85 to 2040-45. Differences among the six sets of projections summarized in table 6 are mainly in base data used, in assumptions about future LDC birth rates, and in interpretations of incomplete data about China and central Africa. Despite these differences, the outcomes in world, LDC, and MDC population estimates for 2000 are quite similar among the first five. The university scholars and the World Bank expect slightly less growth in LDCs than do the U.S. Census Bureau and the U.N. Population Division.

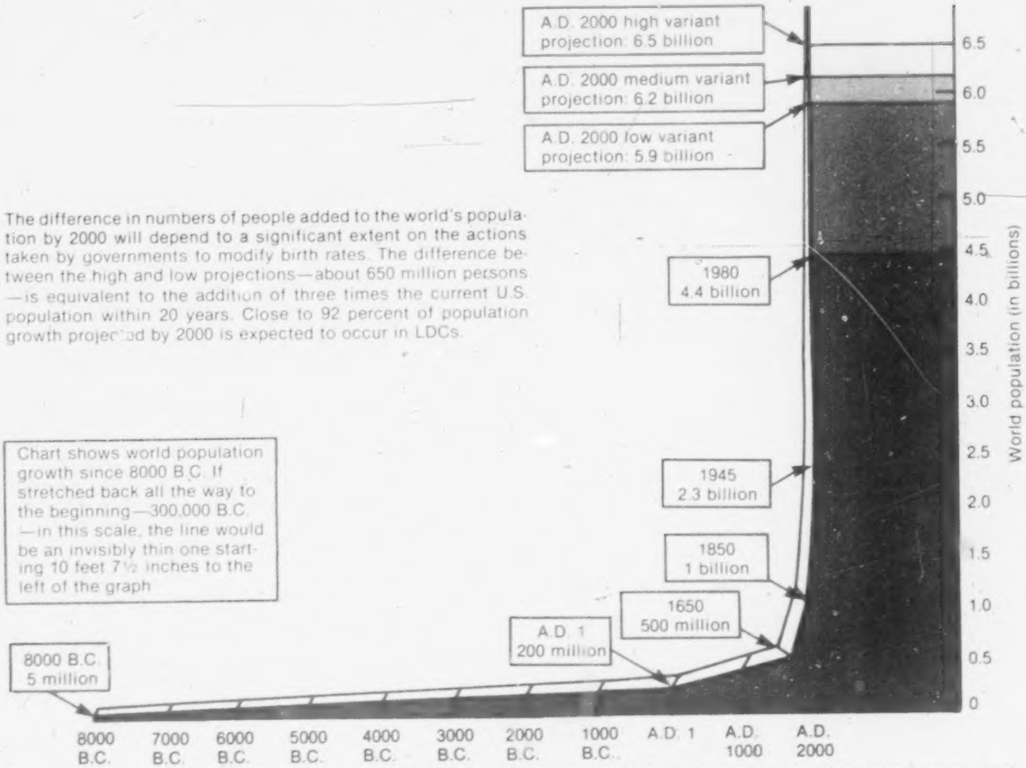
Much of the uncertainty about China should be resolved by its 1982 census and pending improvements in and availability of its birth, death, and birth planning program data. Meanwhile, special population projections for China (1)—based upon China's new emphasis on the one-child family to achieve population stabilization by 2000—come close to the low estimates in table 6.

The U.N. projections have been used as standard reference figures in most of this report but have been supplemented by new national data where available and relevant.

For policymakers concerned with modifying population growth, the most meaningful population information is the difference in numbers of people added to the world's population if governments do or do not take feasible actions to reduce birth rates in addition to those already under way. The actual amount attributable to additional governmental actions that reduce birth rates is neither accurately known nor explicitly stated by most demographic experts who make projections. There is general agreement, however, that if governments intensify current actions to reduce growth rates, the low variant projection is more likely to be achieved. The total difference between the high and low variants is sizable—650 million persons—and is equivalent to the addition of three times the current U.S. population in just 20 years (table 6 and fig. 5).

The tendency of demographers to follow past trends and to underestimate changes in birth rates means that the low variant projections for 2000 are probably not low enough. New information has already led to downward revisions of these low variants. The 1980 Census Bureau low series projection for world population in 2000 was 2-percent lower than in 1977. Some of this change in predictions can be attributed to governmental actions.

Figure 5.—World Population Growth From 8000 B.C. to 2000 A.D.



The difference in numbers of people added to the world's population by 2000 will depend to a significant extent on the actions taken by governments to modify birth rates. The difference between the high and low projections—about 650 million persons—is equivalent to the addition of three times the current U.S. population within 20 years. Close to 92 percent of population growth projected by 2000 is expected to occur in LDCs.

Chart shows world population growth since 8000 B.C. If stretched back all the way to the beginning—300,000 B.C.—in this scale, the line would be an invisibly thin one starting 10 feet 7½ inches to the left of the graph.

SOURCE: United Nations, *World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment*, New York, 1979, projections 1980-2000; Arthur H. Westing, "A Note on How Many Humans Have Ever Lived," *Bipscience*, vol. 31, 1981; graph adapted from "Population Growth from 8000 B.C. to the Present," Oct. 6, 1981, © 1981 by the New York Times Co. Reprinted by permission.

The built-in momentum of population growth

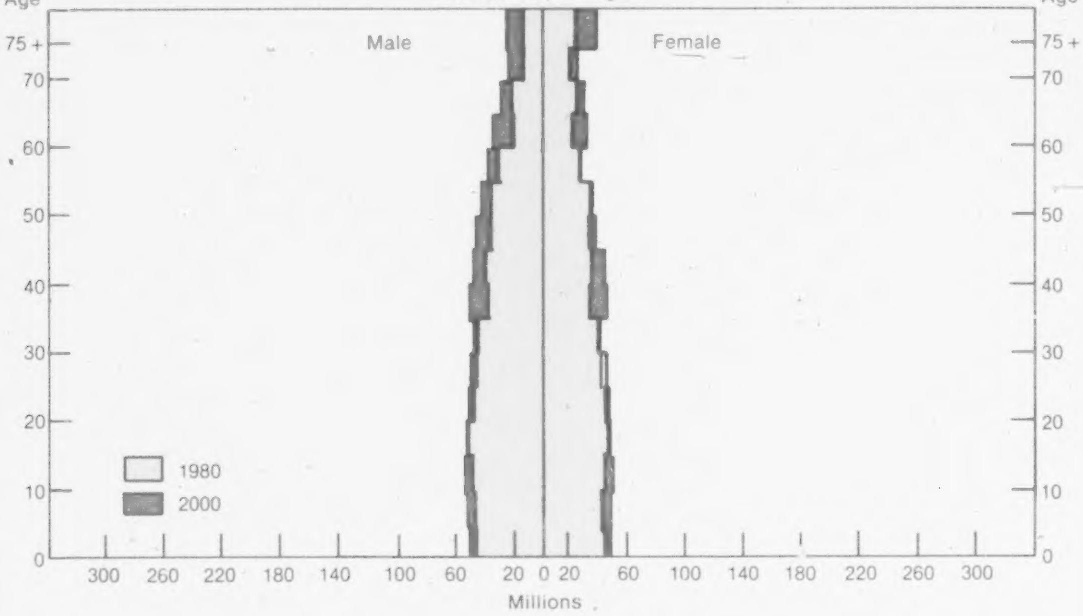
Population growth in the next 20 years has enormous momentum that will affect later population size. This momentum comes from the combination of high fertility and rapidly declining infant mortality in LDCs that followed World War II. The result is a subtle, very powerful built-in inertia, resulting from the age structure of LDC populations (fig. 6A).

In LDCs, far more people are in the younger age groups than in the older ones. Because the number of people entering the reproductive ages each year will be more than 150-percent greater that the number leaving them, *the number of births will be greater each year, even if fertility rates fall dramatically*. Because the younger age groups will be so much larger than the older age groups, the number of people being born each year will be much greater than the number of people dying. Even when fertility approaches replacement levels, the number of deaths will not equal births until the largest cohort of births reaches old age, some 60 years later.

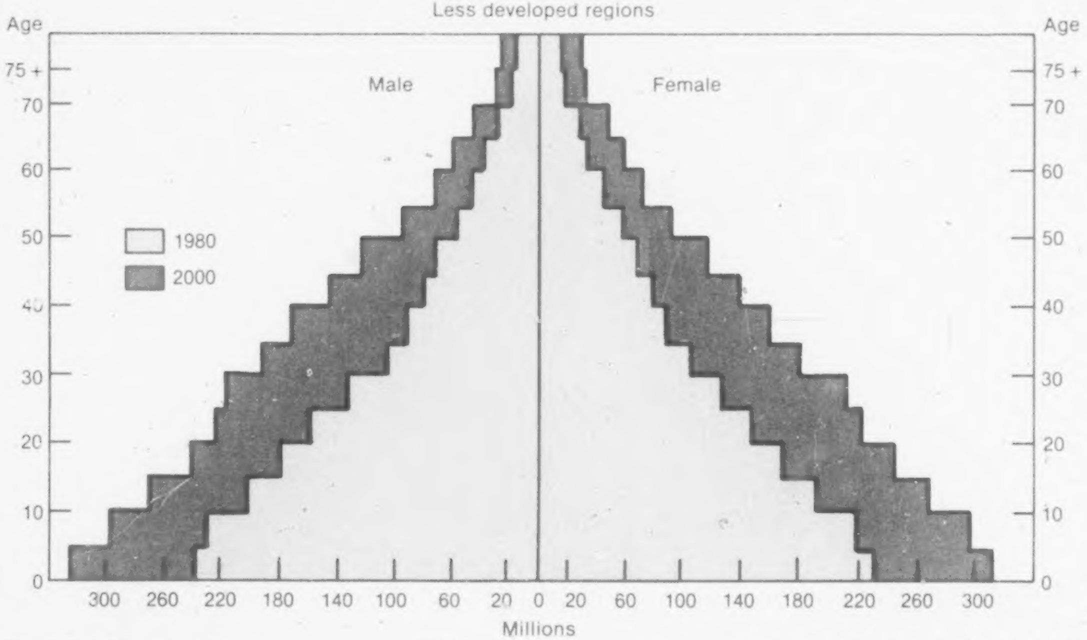
In contrast to the LDCs, by 2000 the MDCs will have a very even distribution of population by age (fig. 6A). The number of people in each 5-year age group between birth and 50 years will be between 87 and 93 million. Each year just as many people will move out of their reproductive years as will enter them. With births at

Figure 6A.—Age-Sex Composition of More Developed and Less Developed Regions, 1980 and 2000: Medium Series Projections

More developed regions



Less developed regions



SOURCE: U.S. Bureau of the Census, Illustrative Projections of World Populations to the 21st Century, Special Study Series, table 2, pt. B, p. 23, No. 79, January 1979.

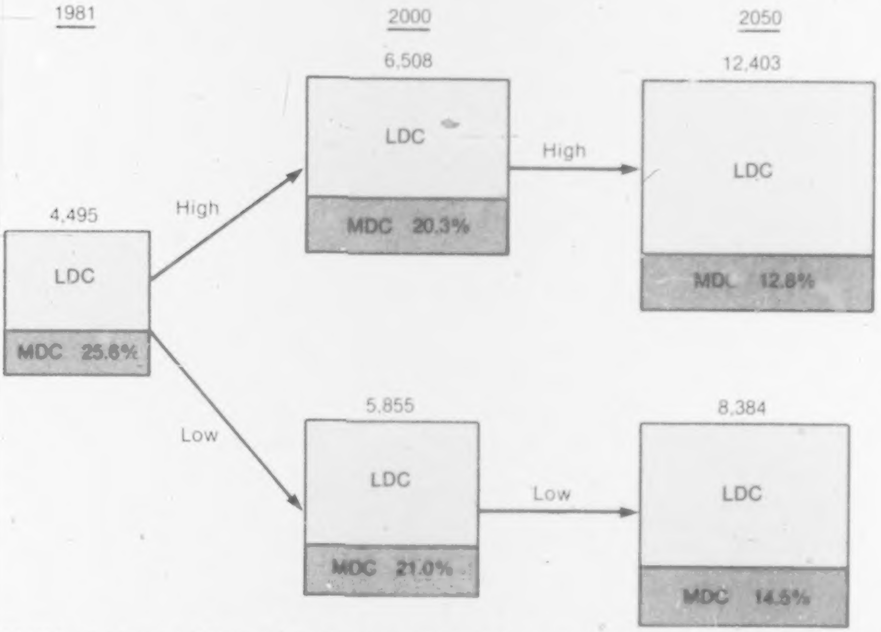
replacement level, approximately the same number of children will be born each year. Furthermore, because the size of the older age groups will be about the same as the younger age groups, the number of children born each year will be about the same as the number of persons dying each year. By 2000, many MDCs are expected to have achieved population stabilization—or zero population growth—with low birth rates equal to low death rates, if their immigration is in balance with their emigration.

One effect of the population momentum in LDCs is to foreclose future options if actions are not taken in time. Frejka and Mauldin (2) conclude that the range between the high and low variants, and thus the range for plausible government options for the eventual size of world population toward the end of the next century, was narrowed by 3 billion people in a single decade. Taking certain actions to reduce birth rates lowered the plausible upper level; not taking other actions raised the plausible lower limit, because by 1980 population momentum had become a part of the built-in growth projection.

How actions taken now can affect the future size of world population is shown in figure 6B. Despite all feasible efforts to reduce birth rates, the world's population will almost certainly double from 4.4 billion to well over 8 billion persons in the next 70 years. But if the world instead chooses a path of high growth by doing nothing further to change trends, an *additional* population roughly *equivalent to that of the entire world in 1981* will be on Earth in 2050. Most of these people would be born in the LDCs, where the initial direct impact of their numbers would be most keenly felt.

The United States is expected to grow from 226 million in 1980 to about 260 million in 2000, and to about 290 million in 2050, while at the same time dropping from 4.9 to 4.0 to 3.5 percent of the world's population. The impact of global population growth on the United States will thus be greatest from beyond its borders.

Figure 6B.—Estimated World Population Growth, 1981-2000-2050 (in billions)



SOURCE: United Nations, 1979. *World Population Trends and Prospects by Country, 1950-2000*. Summary Report of the 1978 Assessment for 1981 and 2000 population figures.

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The magnitude of growth in many LDCs will almost certainly be disruptive within those countries but the challenge to the carrying capacity and stability of the entire world will be felt everywhere. What some of those impacts are likely to be is examined next.

Technical Note A: Projections of population growth

In general population projections for countries and regions are relatively accurate in the short term (10 to 15 years), and fairly inaccurate in the long term (over 20 years). Because migration is rarely a major factor in population growth, and death rates have historically declined slowly, the projection of births becomes the crucial element. For example, in the United States, the birth rate fell from 30 (30 births per 1,000 population) in 1915 to 19 in 1935, rose sharply to 25 during the "Baby Boom" year of 1955, and dropped to 15 in 1975. The causes of these changes, which are partially understood after the fact, could not have been predicted.

Even when a birth rate projection misses the actual number by a significant margin, the projection of the total size of the population may still be reasonably accurate over the short term. In a slowly growing population, the proportion of those under age 15 is about 25 percent; in a rapidly growing population this proportion can reach 50 percent (see fig. 2A, ch. 1). In the slowly growing population, a 20 to 30 percent error in estimating births would result in a 5 to 6 percent error in the total size of the population after 15 years. In the rapidly growing population, a projection with this error would be about twice as inaccurate. Errors in projecting birth rates begin to have a much greater effect after 15 years, when children born during the early years of the projection begin to reach reproductive age. Thus any over- or under-estimation of their birth rates will cause errors in the projection to accumulate rapidly.

A second crucial factor in making population projections is the accuracy of the data on population size and on birth and death rates for the base year. If the size estimate is in error, the projection will be inaccurate by the amount of error from the beginning. Inaccuracies will be compounded to the extent that birth and death rate data are inaccurate. This factor is the most serious problem in projecting population growth rates in LDCs, where data are often of poor quality.

Projections made in prior decades for the year 1980 illustrate this problem of poor quality baseline data. The U.N.'s most recent projection estimates world population at 4.43 billion in 1980. In 1973 this projection was 4.37 billion (1.3 percent less than the 1980 estimate); in 1963 it was 4.33 billion (2.2 percent less); and in 1957 it was 4.22 billion (4.7 percent less). The major factor affecting these projections was the inaccuracy of base data on death rates. The death rate for 1960-65 was estimated in 1963 to be 15.9 per 1,000 for the world and 19.2 for LDCs. Today the respective rates for 1960-65 are estimated to have been 14.4 (10 percent less) and 16.8 (12.5 percent less). The decline in death rates was projected fairly accurately, but the higher base figures led to low overall growth rates. Birth rates were estimated more accurately for the base years but were projected to decline more slowly than they actually did, which compensated to some extent for the high death rate projections. Based on calculations of error and estimates of quality of current baseline data, projections for 2000 have an uncertainty range of 10 to 20 percent.

Technical Note B: Exponential growth

The concept of exponential growth can be illustrated by observing, during a certain length of time, a theoretical population in which the rate of reproduction per individual remains constant. Each female on average leaves two females in the next generation. (Population growth is measured by the number of females each woman has since women bear children and the ratio of males to females is usually close to 1:1). The two females leave four females in the next generation; the four leave eight, the eight leave sixteen, and so forth. If this were a population with an age at marriage (generation length) of 20, the population would double every 20 years. Because individuals in this population are reproducing at a constant rate, the rate at which the population increases depends on the number of people at the beginning. A population with 10 females at the beginning increases faster than a population with two females at the beginning even though each is reproducing at the same rate. This kind of population increase, known as exponential growth, is also referred to as geometric or logarithmic growth. If exponential growth were to continue unchecked, the world would soon contain more living organisms than atoms in the universe. The factors that keep this growth in check are the number of deaths in a population (growth rates slow if death rates rise), the time between generations (age at marriage in human populations), and the number of offspring each couple has (fertility). (Migration is a factor only for individual countries.)

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Chapter 3

Implications of World Population Growth

Abstract

Less developed countries (LDCs) are experiencing severe environmental and resource pressures to which more developed countries (MDCs) substantially contribute because their fewer numbers consume the greater proportion of the world's resources. Lower consumption levels in MDCs plus agricultural and other developmental aid to LDCs would ease many of these pressures. The continuation of traditional land-use patterns by rapidly rising numbers of people has significantly weakened the resource base of many LDCs, whose governments must achieve huge future increases in agricultural production to keep pace with unprecedented population growth. Food resources are expected to be adequate to the year 2000, but distribution will remain a serious problem, and the burden of increased production will fall largely on marginal lands. Most LDCs are in one of four situations: 1) those with severely limited resources and heavy population pressures, 2) those with resource potential that are slow to exploit it, 3) those with periodic food surpluses, and 4) those with food shortages but the ability to import. World aquatic yield has declined slightly since 1970. Global water supplies, now about 10 times demand, are projected to fall to 3.5 times demand by 2000. Water supplies are already critical in some areas and international disputes over water rights are likely to intensify. International energy demands indicate a difficult future for LDCs; high oil prices, dwindling fuelwood supplies, and use of needed fertilizers (dung, crop residues) as fuels have contributed to decreasing rates of economic growth. Continuation of today's rate of deforestation, with its concomitant large-scale soil erosion and decreased soil productivity, could reduce the world's forests by 18 to 20 percent by 2000. Human intervention has so far altered some 15 to 17 percent of the Earth's land area; of the world's land surface, only 30 to 36 percent has significant life-support capability with present technology. The outcome of human impact on the global temperature is uncertain. Less rapid population growth would reduce pressures to provide health care, education, and employment opportunities in LDCs. The impact of population growth on political stability depends on its interaction with the social, economic, and political structure of the society involved. Because rapidly rising numbers of people can limit the ability of governments to meet the expectations of their people, conflicts can have demographic roots. Growing populations of rural landless, explosive urbanization, and large-scale migration can exacerbate socioeconomic burdens in LDCs and influence stability in MDCs. High population growth rates influence the social, economic, and political factors that threaten the stability of many LDCs in which the United States has vital security interests; many contain such tangible commodities as oil, chromium, and vanadium. Less tangible but probably far more important is the significance of some of these countries to regional stability and the balance of global power. Rapid population growth is intensifying current environmental, food, energy, and resource pressures in LDCs. Its interaction with these problems has generated a new category of national security concerns, the implications of which remain largely unexplored.

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Resource demands and environmental degradation

LDCs are experiencing severe environmental and resource pressures. MDCs contribute substantially to these pressures because their far fewer numbers consume the greatest proportion of the world's resources. Effective efforts to curb consumption levels in MDCs combined with agricultural and other developmental aid to LDCs would ease some of the most serious stresses faced by the developing world.*

In many LDCs, farmers subsist by clearing forestland that has marginal productivity, quickly wearing out the soil, and moving on to clear more forest. The traditional use of wood and charcoal for cooking cuts further into the tree cover, and forested areas rapidly disappear. The Philippines lose an estimated 200,000 hectares of forest each year and Thailand's forests are vanishing at the rate of 250,000 hectares annually. Droughts have become more frequent and severe; floods are unmoderated by forest buffers; erosion is extensive; irrigation and hydroelectric systems are silting in. India, Brazil, Indonesia, Costa Rica, Burundi, the Ivory Coast, Burma, Haiti, Honduras, and Nepal are among the nations facing similar problems. Yet these countries must achieve huge increases in agricultural production in the years ahead to keep pace with their rapid population growth.

Although its most direct effect is seen in the pressures exerted on agricultural systems, rapid population growth exacts a heavy toll on other important resources. It also points to complex interrelationships between the demands on food, water, and fuel resources and their resulting impacts on the environment, on the social and economic progress of developing nations, and on the political stability of the world at large.

Food

Most experts estimate that world food resources will be adequate to 2000, but many countries will have severe production and distribution problems. MDCs presently have sufficient surplus production to be able to export to LDCs, but distribution systems in these countries are inadequate to ensure the receipt of food by those in greatest need. In the future, some of the wealthier LDCs will be able to import food, but many poor LDCs will have insufficient financial resources and are likely to experience continued food deficits.

Food production to 2000 is projected to increase by 2.8 percent per year in Africa, 3.0 percent per year in Latin America, and 2.6 percent per year in Asia (6). Whether LDCs can by then be relatively self-sufficient will depend to a great extent on the magnitude of their population growth. In Africa, domestic food production can currently meet 86 percent of calorie requirements. Depending on whether the high or low population projection becomes reality by 2000, this proportion either decreases to 80 percent or increases to 92 percent. In Latin America, domestic production, currently at 84 percent of food requirements, would increase in either the high or low population projections, but the difference would be between meeting 87 or 101 percent of food requirements. In Asia, the increase would be from 95 percent today to either 110 or 120 percent by 2000.

Even when total production approaches 100 percent of food requirements, caloric intake is often insufficient among large segments of the population because of losses in storage and transit and the proportion of those whose intake is above average. Although food production may rise sufficiently to meet minimum calorie requirements in some poor LDCs, severe problems of distribution are likely to continue.

Most LDCs are in one of four situations:

1. Countries with severely limited resources (land and technology) to increase food production, most of which face heavy population pressures and have little unused arable land (e.g., Bangladesh, Pakistan, Egypt).
2. Countries that have potential but are slow to exploit it. They have land available for agricultural development, good climate,

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*The projections on the impacts of population growth in LDCs included in this chapter were prepared for OTA by The Futures Group (9), whose full report is published as a working paper.

solid infrastructure, and an abundance of other natural resources (e.g., the majority of Latin American countries).

3. Countries with periodic food surpluses (e.g., Thailand, Brazil).
4. Countries that have food shortages but are able to import (e.g., South Korea, Saudi Arabia).

Food production increases are achieved by increasing yields of lands now under cultivation and by opening new lands. Because the most productive lands have already been brought into production in most areas, pressures to increase production will fall on marginal lands, with consequent need for far-higher use of irrigation, fertilizers, pesticides, herbicides, and higher yielding crop strains than for productive lands.

Production from another important source of food, the world's oceans, lakes, and rivers, has declined since the peak year of 1970 (3). The contribution of the aquatic yield to global food requirements is about 25 percent of required protein. Even if the total aquatic yield could be increased from its present 70 million to 100 million metric tons by 2000, through the exploitation of new species and the emergence of a large marine-culture industry, the world's population will increase at a slightly higher rate.

Water

An adequate supply of water is the most important factor in raising agricultural production in large areas of the world. Global water supplies are now about 10 times demand. Projected growth of irrigation and domestic water use would reduce these supplies to about 3.5 times demand by 2000. Irrigation for food production is the major use of water, accounting for 70 percent of total water use in Africa, 88 percent in Asia, and 60 percent in South America.

The water supply is already critical in various areas of the world for different reasons. In areas such as the Middle East, population densities are low (the Nile River Valley is an exception), but water is very scarce because people are crowded close to the few available water sources. In other areas, although there may be considerable seasonal variability, large quantities of water are available, but populations are also very large. The Ganges River basin, for example, is expected to contain more than half a billion people by 2000. In still other areas, water is used for many purposes, straining supplies even though population density in the immediate area is not high. For example, the United States uses Colorado River water for irrigation, municipal, and industrial purposes, sharply reducing the down-river flow into Mexico and increasing the salt content of what remains.

Table 7 compares 60 LDCs by per capita water availability (assumed needs: 1,000 cubic meters per capita per year) in 2000. North Africa and the lower Middle East already have severe water supply problems, and most of their populations are expected to double by 2000. Much of Asia and the rest of Africa are in similar positions.

International disputes over water rights are likely to intensify. Worldwide, 148 of the world's major river basins are shared by two or more countries. For example, there are longstanding disputes over the Jordan River (Jordan and Israel), the La Plata (Brazil, Argentina, Uruguay), the Euphrates (Syria, Iraq), the Indus (India, Pakistan), and the Ganges (India, Bangladesh).

Photo credit: Agency for International Development

Haitian farmers plant tree seedlings in efforts to restore eroded hillside

Table 7.—Projected per Capita Water Availability in the Year 2000
(thousand cubic meters per capita per year)

Per capita water availability	Sub-Saharan Africa	Asia	Latin America	North Africa and Middle East
High availability (above 10)	Angola Cameroon Ivory Coast Madagascar Zaire Zambia	Burma Kampuchea Malaysia	Bolivia Brazil Chile Colombia Costa Rica Ecuador Honduras Peru Venezuela	
Medium availability (5 to 10)	Mali	Nepal Philippines	Argentina Guatemala	
Low availability (1 to 5)	Ethiopia Ghana Kenya Mozambique Niger Senegal Tanzania Uganda Upper Volta	Afghanistan China India South Korea Sri Lanka Thailand	Cuba Dominican Republic El Salvador Mexico	Iran Iraq Sudan Turkey
Very low availability (0 to 1)	Malawi Morocco	Bangladesh Pakistan	Haiti	Algeria Egypt Saudi Arabia Tunisia

SOURCE: Futures Group, 1980, contractors report to Office of Technology Assessment.

Energy

The global energy situation signifies a difficult future for much of the developing world. While many of the industrialized countries have raised the prices of their exported goods, thereby buffering the impact of higher costs for oil imports, most LDCs have not been able to effectively do so. They have suffered a double hardship by paying higher prices for both oil and other imports.

Consumption of commercial energy (oil, gas, coal, etc.) is more closely tied to economic growth and level of development than to population growth. But the demand for "noncommercial" fuels is directly related to population growth.

Wood is the most widely used noncommercial fuel and supplies the majority of all energy used in many LDCs. Worldwide, wood burned for fuel provides energy equal to that derived from all hydroelectric sources. LDCs consumed about 90 percent of all fuelwood used in 1974, which provided between 30 and 60 percent of their total energy (1).

Wood can be a renewable resource, but encroachment on forests for farming and fuel has resulted in widespread shortages. Charcoal is frequently adopted as a fuel when deforestation extends beyond distances from which fuelwood can be economically transported, because charcoal contains about four times the energy per unit weight as wood. But because much of the energy value of wood is lost in the process of charcoal manufacture, intensified charcoal use will accelerate the problem of deforestation.

Rising commercial fuel costs and diminishing supplies of fuelwood are forcing many people in LDCs either to greatly reduce fuel consumption or to find alternative fuel sources. Among these are dried dung and crop residues. Because of fuel shortages, increasing numbers of people have only these materials to burn. Yet they are needed to maintain soil productivity, as subsistence farmers can rarely afford commercial fertilizers, and when they are burned, energy is gained at the expense of land productivity.

Burning of dung and crop residues is already extensive in India, Nepal, other parts of Asia, and in the Andes of South America. Worldwide, between 150 million and 400 million metric tons of dung are burned for fuel every year. As about 50 kilograms of additional food grain can be produced from land fertilized by a ton of dung, this burning represents a potential loss of between 8 million and 22 million metric tons of food grain.

Population growth can make a substantial difference in the "affordability" of commercial energy on the economy. Although supply-price constraints are likely to depress economic growth and gains in living standards, at a given level of economic growth, gains in living standards can be much higher when population growth rates ~~are~~ lower. A higher population ~~growth rate means~~ that ~~roughly the~~ same amount of gross national product (GNP) must be divided among a larger number of people.

Commercial energy requirements have historically been closely linked with growth in GNP. A 1-percent increase in GNP is associated with a 0.95-percent increase in commercial energy requirements. The tremendous oil price increases that most oil-importing LDCs have had to pay have meant large balance-of-payment deficits and increased debts to finance decreasing, rather than increasing, rates of economic growth. The World Bank has estimated that GNP growth rates collectively fell by more than 60 percent in LDCs between 1973 and 1975, from an annual growth rate of 7.6 to 3 percent. Higher rates of population growth require more commercial energy, necessitating more rapid growth in GNP—growth that cannot always be assured and that appears unlikely to occur in some countries.

Environmental effects

Forests now cover about one-fifth of the world's land surface but are being depleted at a rate of 18 million to 20 million hectares per year, a reduction rate of about eight-tenths of 1 percent per year. If this rate were to persist to 2000, forests would be reduced by 18 to 20 percent, or to one-sixth of the world's land surface. Very little forested area remains in such heavily populated countries as India and Pakistan. Deforestation has razed about 10 percent of Brazil's forests, 30 percent of those in Honduras, and over 90 percent of those in Haiti. The removal of the forest canopy results in large-scale soil erosion, decreased soil fertility, landslides, silting-in of reservoirs and irrigation channels, drought, desertification, and the extinction of forest plant and animal species.

Photo credit: Agency for International Development

Makeshift housing characterizes the outlying areas of most cities in LDCs

Direct human intervention has caused the transformation of some 9 million square kilometers (km²) of savanna to desert; 600,000 km² of forest to fields, grassland, or savanna; and 1 million km² of fields or forests to paved areas and urban buildings—a total alteration of some 15 to 17 percent of the Earth's land area (8). Much of the best agricultural land lies near urban centers and is being used for urban and industrial development. These alterations are important because only 30 to 36 percent of the Earth's total land area is fit for agricultural activities or has significant life support capabilities with present technologies.

The U.S. Department of Agriculture estimates that the rapidly rising growth of cities in the developing world is cutting arable land in LDCs by 0.03 hectare per capita per year (1 hectare equals 2.47 acres). If the most likely population projection becomes reality, this rate would lead to a loss of 49 million hectares of arable land from food production by 2000, an amount presently calculated to feed some 165 million people. If the low projection is achieved, the quantity of land lost would fall to 41 million hectares, but if population totals rise to the high projection, this loss would reach 56 million hectares by 2000, an amount that could have fed 188 million people.

The impact of converting arable land is graphically illustrated by the case of Egypt, where the current total of 25,000 hectares of cultivable land lost each year is expected to rise as the pace of urbanization quickens. Despite large investments to expand the country's irrigated land area with water from the Aswan Dam, irrigated land totals remain essentially unchanged because old producing lands are lost at about the same rate that new hectares are irrigated. If its present population growth rate continues, Egypt's goal of food self-sufficiency will be difficult to achieve.

The increased pollution that accompanies rapid urbanization has overwhelmed the ability of many LDC governments to provide sanitation and other public services. In 1976, fewer than one-third of LDC city dwellers lived in housing connected to sewer systems and less than 4 percent of this housing was connected to some form of sewage treatment facility. Air pollution problems have become critical in the urban centers of such cities as Mexico City, Sao Paulo, and Bombay.

The leading cause of the transformation of productive land into deserts is overgrazing. Overgrazing and overcropping, combined with drought, are rapidly expanding deserts in the Sudan and Sahelian regions of Africa.

Irrigation often causes long-term problems of loss of soil productivity through waterlogging, salinization, and alkalinization. These problems occur when irrigation systems provide poor drainage or where there is improper use of fertilizer. Evaporation of water from soil surfaces leaves residues of salt that form a mineral crust on the surface that can kill plants or inhibit their growth.

Anthropogenic land-use changes are said to have played a role in depressing the global temperature by about 0.2° C over the past 25 years, and this temperature could fall by another full degree by the end of the century (8). Other studies suggest that the release of chemicals, particulates, and carbon dioxide into the air—the most serious human-induced threat to climatic stability—could instead result in a gradual warming trend (7). Still others project little or no effect on global temperatures. There is no doubt that humans have caused significant changes in the environment, but whether these changes extend beyond the microclimates of specific regions is still being debated.

Economic and social impacts

The numerous pregnancies, closely spaced pregnancies, and additional pregnancies at comparatively late ages that are associated with rapid population growth are also associated with higher rates of illness and death for both mothers and infants.

An important health side effect of high fertility is nutritional deficiency. Each additional child in a poor family may be believed by the family to provide greater social security for the parents' old age, but available food must also be divided among a larger number of people. Malnourished children are more vulnerable to disease and their physical and mental growth may be retarded.

When women are malnourished during pregnancy, they are likely to develop maternal depletion syndrome,* and while infants derive important benefits from breastfeeding, the practice further compromises the nutritional status of malnourished mothers. There is a high incidence of infant mortality and low birth weights in almost every part of the world where

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*Maternal depletion syndrome is characterized by several disease states including anemia, osteomalacia, and iodine-deficiency goiter. It is caused by multiple repregnancies occurring while the woman is suffering protein-calorie deprivation. Its effects are cumulative and contribute to low birth weight infants, failure to gain sufficient weight during pregnancy, and a decrease in subcutaneous fat and muscle tissue. The process undoubtedly plays a part in the premature aging and early death often seen among women in LDCs.

Photo credit: Agency for International Development

Young mother in Bangladesh holds her malnourished child

fertility rates are high. The percentage of infants weighing less than 2,500 grams (the weight index for prematurity in MDCs) rises from 4 to 7 percent in MDCs to 10 to 20 percent in Latin America, 10 to 15 percent in Africa, and 10 to 30 percent in Asia (6). Low birth weights are strongly associated with infant morbidity and mortality.

Education is a primary vehicle for economic development, and leads to a better trained, more productive work force. It is a top priority in most LDCs, which face the double burden of increasing enrollment rates while trying to keep pace with soaring growth in numbers of school-age children. There is also a strong feedback relationship between education and population growth rates, as education, particularly for females, is related to lower fertility rates.

In a rapidly growing population, the number of dependents is large compared to the number of workers. In most LDCs, 40 to 50 percent of the population is under age 15. This group of 1.4 billion people will enter their economically active years during the next 15 years. But the International Labor Organization estimates that the underemployed already account for almost 30 percent of the labor force in Latin America and 36 to 38 percent in Asia and Africa. Reductions in fertility and mortality for the African countries will be particularly significant because of the difference between the high and low projections of population growth (table 8). In Kenya, for example, annual new job requirements in 1975 were about 170,000. By 2010, the number of new jobs needed annually, primarily for young people just entering the job market, would rise more than fivefold under the high projection—to 900,000—as compared with 530,000 under the low projection of population growth.

Per capita income increases only to the extent that gross domestic product (GDP) growth exceeds the rate of population growth. But rapid population growth requires high rates of investment at the same time that it makes domestic savings more difficult.

Table 8.—Average Annual Growth of Labor Force for Selected Countries

		2000-2025		
	1970-77	Low variant	Medium variant	High variant
Sub-Saharan Africa:				
Ethiopia	1.8	1.9	2.7	3.1
Kenya	2.8	2.7	3.4	3.9
Nigeria	2.0	2.8	3.4	3.7
Tanzania	2.3	2.5	3.2	3.5
Zaire	1.9	2.1	2.4	2.9
Asia:				
Bangladesh	2.3	2.2	2.6	3.0
India	1.7	1.3	1.6	1.9
Indonesia	2.0	1.3	1.7	2.0
Malaysia	3.6	1.1	1.3	1.6
Pakistan	2.4	2.2	2.6	2.9
Philippines	2.1	1.6	1.9	2.3
Sri Lanka	2.1	0.7	0.8	1.1
Latin America:				
Argentina	1.2	0.5	0.7	0.9
Brazil	2.8	1.6	2.3	2.9
Colombia	3.5	1.2	1.9	2.4
Mexico	3.3	2.5	2.9	3.2
Venezuela	3.3	1.7	2.1	2.6
North Africa and Middle East:				
Egypt	2.2	1.6	1.8	2.2
Iran	2.5	2.0	2.3	2.6
Morocco	2.7	2.3	2.6	3.0

SOURCE: The Futures Group, "The Impacts of Population Growth on Less Developed Countries," report prepared for the Office of Technology Assessment, 1980.

The extraordinary period of the 1960's and 1970's illustrates this point. World population growth, at an average annual rate of 1.9 percent, was greater during these two decades than at any other period of human history, and the economic growth rate of more than 5 percent per year was also unparalleled in human history. World income per capita grew rapidly, averaging about 3.2 percent per year.

Although economic performance in terms of aggregate growth of output was about the same for LDCs and MDCs, a substantial difference in demographic growth gave MDCs a marked advantage in per capita income. The LDC population grew by 1.2 billion people during this period, at an annual rate of more than 2 percent, while MDC numbers rose by fewer than 200 million, at a rate of less than 1 percent. MDC per capita income growth exceeded 4 percent annually, but LDC growth remained below an annual rate of 3 percent. The absolute income gap between LDCs and MDCs widened significantly between 1960 and 1978, but the relative gap—as measured by per capita income—widened to a far greater degree (4).

Thus, population growth, even when rapid by historical standards, does not necessarily prevent significant and even very high rates of per capita income gain. But to overcome the economic burden of rapid population growth requires rates of economic advance that exceed the rate of natural population increase by a substantial margin. Given the demands for services, employment, etc., by constantly rising numbers of people in the next two decades, declines in rates of economic growth are likely. Thus, population growth aggravates the economic problem of many countries that have had to borrow from outside sources, and their increasing debts are now becoming a hindrance to development.

The combined benefits of slowing population growth—on health, education, and the economy—are all interrelated. A smaller child population makes it easier to provide quality education and health care to young children. It also reduces dependency ratios, which can lead to increased savings. A healthier, better educated work force is more productive. Increased savings can lead to more investment, more capital per worker, and, again, higher worker productivity. The resulting higher output and income can, in turn, make it possible to provide still better health care and education to the young population.

Political consequences

The impact of population growth on political stability depends on its interaction with the social, economic, and political structure of the society involved. The ability of any government to meet the needs and demands of its people is clearly a critical element in that government's medium- and long-term survival. There is general agreement that political stability is jeopardized when the expectations of individuals and groups are not fulfilled. Resultant frustrations can then lead to political and social unrest as increasing numbers of people place ever greater demands on the limited capacity of national governments and economies to provide desired goods and services.

Although demographic factors such as rapid population growth do not act alone or directly cause conflicts, conflicts that have been viewed as primarily due to political causes can have demographic roots (2). Religious, social, and racial differences are important contributors to violence and conflict, and differential rates of population growth among separate ethnic, linguistic, or religious groups can generate serious political strains.

Rapid population growth in rural areas can jeopardize political stability in several ways. As rural population densities rise, existing agricultural acreage must either be divided into ever smaller parcels or an increasing proportion of the rural populace must be left landless. Either result can lead to political unrest as living standards decline and frustrations grow. Rural population growth also stimulates migration from rural to urban areas, as people search for the better economic and educational opportunities that urban centers are more likely to provide. Explosive urbanization in turn strains service systems, disrupts sociocultural networks adapted to village life, and throws diverse ethnic and tribal groups into unaccustomed proximity and competition. Tensions in urban areas can be further exacerbated when there are large numbers of unemployed or underemployed persons, whose frustrations create opportunities for turmoil. Such groups are often vulnerable to exploitation by extremist factions.

Another demographic factor, emigrant and refugee movements, is as old as the history of human settlements. What is new in the present situation is the scale—the immense numbers of people involved—and the lessened capacity of nations to absorb these migrations. Large-scale movements of emigrants and refugees can occur either directly in response to economic distress and political persecution or indirectly as a consequence of civil or international strife. Examples include the refugee flight from East Pakistan to India in 1971-72, the migration from Mexico and the Caribbean to the United States, the flight of refugees from Vietnam to other countries of Southeast Asia, and the movement of Palestinians, Egyptians, and others within the Middle East.

For LDCs overburdened by the strains of rapid population growth, large numbers of new arrivals exacerbate an already difficult situation. Growing ethnic consciousness and nationalism can also reduce the absorptive capacity of a society. In MDCs there is a growing consensus that their capacity to absorb new immigrants under the economic conditions of the 1970's and 1980's is increasingly limited. After years of encouraging the inflow of Turkish and other "guest workers," West Germany has reversed its policy and has tried to induce these laborers to return to their countries of origin. This mirrors a parallel tightening of already stringent immigration policies by other European countries. The United States still accepts immigrants on a large scale, but that policy is the subject of increasing debate, in part because illegal immigrants match or exceed legal immigrants. The era has passed when large, sparsely populated, and resource-rich lands—such as Australia, the United States, and Canada—were willing to absorb the excess populations of other countries.

National security and international stability are also affected when recipient countries take actions to block or expel unwanted entrants. The decision of India to invade Pakistan in 1971 may have been to some degree influenced by a determination to stop the flow of 9 million to 10 million Pakistani refugees into West Bengal (India). This refugee influx was due to political unrest in West Pakistan, which in turn has been attributed to that areas's population pressures (2).

High population growth rates influence the social, economic, and political factors that threaten the stability of many of the LDCs in which the United States has vital security interests. These interests include such tangible commodities as oil, chromium, and vanadium imported by the United States. Less tangible but probably far more important is the significance of several of these countries to regional stability and the global balance of power (table 9).

In sum, rapid population growth is an intensifier of current environmental, food, energy, and resource pressures in LDCs, and its interaction with these problems is generating a new category of national security concerns. The implications of this interaction for national security, a term which is itself changing, remain largely unexplored.

Table 9.—Population Trends in Selected Countries Involving U.S. Security Interests

Country		Total population mid-1981 (millions)	Annual population increase[a] (percent)	Total population doubling time (years)	Population under age 15 (percent)	Annual urban population increase (percent)	Urban population doubling time (years)
All MDCs		1,138	0.6%	113	24%	1.4%	50
LDCs		3,357	2.1	34	39	4.0	17
Selected countries:	**Strategic importance**						
Bangladesh	Collapse or political realignment would have destabilizing effect on Indian subcontinent	91.4	2.6%	27	44%	6.7%	10
Bolivia	Source of tin, antimony, tungsten	5.7	2.5	28	42	4.3	16
Brazil	Source of manganese ore, columbium and iron ore; size; leadership role in Latin America	130.0	2.4	29	41	4.0	17
Central America	Panama Canal; excessive emigration to U.S.; proximity	95.9	2.7	26	46	4.1	17
Egypt	Key to U.S. strategies for peace in Middle East	43.1	3.0	23	40	3.4	20
India	World's second largest country; key to stability Indian Ocean region and U.S.-Soviet balance	709.8	2.1	33	41	3.8	18
Indonesia	Major source of U.S. oil imports; fifth largest country in world; strategic location as U.S. ally in Southeast Asia	155.4	2.0	35	42	4.2	17
Kenya	Leader of pro-Western African states; U.S. military access agreement	17.0	3.9	18	50	7.1	10
South Korea	U.S. military ally; potential staging area; possible North Korean threat	38.6	1.7	41	38	4.1	17
Mexico	Size; proximity; major source of strontium, cadmium, and major potential source of oil and gas; large labor migration to the U.S.	72.4	2.5	28	46	4.4	16
Morocco	Major source of potassium; U.S. friend in North African conflicts	21.0	3.0	23	46	4.8	14
Nigeria	Second largest source of U.S. oil imports; one-fourth of total African population	79.7	3.2	22	47	5.6	12
Pakistan	Principal bulwark against Russian move into Gulf of Oman and Indian Ocean	85.1	2.8	25	46	4.7	15
Philippines	Source of chromite and copra; military ally with key U.S. bases; strategically important	52.5	2.4	29	43	4.1	17
Somalia	Strategic location; U.S. friend in conflicts over Horn of Africa	3.8	2.8	25	44	5.4	13
Thailand	Source of tin, tungsten and tantalum; military ally; strategic importance in Southeast Asia	49.0	2.0	35	43	4.2	17
Turkey	Eastern anchor of NATO; strategic window on the U.S.S.R.	46.5	2.2	32	40	4.3	16
Venezuela	Source of oil and vanadium	15.4	3.0	23	43	3.9	18
Zimbabwe	Major source of chrome; key to political stability in Southern Africa	7.7	3.4	21	47	6.3	11

[a] Natural increase, exclusive of emigration and immigration.

SOURCES: Draper Fund, 1981; U.N., 1979 *World Population Trends and Prospects by Country, 1950-2000: Summary of the 1978 Assessment*

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Chapter 4

The Direct Determinants of Fertility Change

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Chapter 4

The Direct Determinants of Fertility Change

Abstract

Fertility, mortality, and migration determine population change: if births plus net immigration exceed deaths, populations grow. Because no government advocates raising mortality rates and few encourage emigration, fertility change is the most viable option for countries that wish to lower population growth rates. Among the many factors that influence fertility, such as education, desired family size, and value and cost of children, eight directly influence the number of live births that occur, and four of these--lactation, proportion married and age at marriage, induced abortion, and contraceptive use—are most likely to contribute to any significant reduction in birth rates in the next 20 years. The relative influences of the remaining direct factors—frequency of intercourse, natural sterility, spontaneous abortion and fetal mortality, and duration of the fertile period during a woman's menstrual cycle—are likely to change only slightly. Because lactation temporarily suppresses ovulation, breastfeeding can lower fertility rates, but is an unreliable contraceptive for individuals. Age at marriage and proportion married influence fertility because most births take place in stable unions and women who marry at later ages are exposed to the possibility of pregnancy for fewer years. In some countries, both rising age at marriage and contraceptive use have contributed to fertility declines. Age at marriage will continue to be an important factor in less developed countries (LDCs) for the next 20 years because there will be more young adults in their peak reproductive years than ever before in history. An estimated 55 million induced abortions are performed in the world each year; more than half occur in LDCs. Changes in abortion laws have occurred in recent years for reasons of public health, social justice, women's rights, and government population policies. The incidence of induced abortion and maternal mortality from improperly performed procedures can be reduced by improving access to effective contraceptive services. Contraceptive prevalence rates, which are reliable predictors of crude birth rates, vary widely among countries, and more urban than rural women use contraception because many family planning programs are not yet effectively reaching rural areas. Contraceptive use has been established as of central importance in achieving replacement fertility.

Introduction

The determinants of population change are fertility, mortality, and migration. If the number of births plus net immigrants exceeds the number of deaths, the population grows. No government advocates raising mortality rates, and few countries encourage emigration. Thus, fertility change is the most viable option for countries that wish to lower population growth rates.

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The factors that influence fertility include the motivation to have children; decisions about family size; relationships between child mortality and desired family size; value and cost of children; a couple's level of education, income, and occupation; decisionmaking power within the family; influence of peer groups and family; availability of family planning services; and external factors related to the development level of the country in which a couple lives. (See ch. 7.) These factors influence fertility by mediating other direct factors (usually termed intermediate or proximate) that in turn directly influence fertility. For example, the level of education of women is frequently found to be inversely related to fertility—women with more education have fewer children than those with less education. But other factors emerge on detailed examination: women who are better educated are more likely to marry later and to practice contraception, thus reducing the number of children they bear. These latter two factors—age at marriage and contraceptive use—directly influence fertility, whereas education is an indirect influence.

Eight factors directly influence the number of live births that occur: 1) proportions married and age at marriage, 2) contraceptive use, 3) induced abortion, 4) lactation (breastfeeding), 5) frequency of intercourse, 6) natural sterility, 7) spontaneous abortion and fetal mortality, and 8) duration of the fertile period during a woman's menstrual cycle. The first four of these elements are the most likely contributors to any significant reduction in births in the next 20 years (2,3,6).

The latter four elements are likely to have little impact on birth rates during this period. Normal variations in the frequency of intercourse have relatively little impact on fertility rates except in cases of spousal separation due to migratory work patterns or war.

Natural sterility displays the same general pattern in all populations; it increases with age. Although at young ages sterility averages about 5 percent, by age 35 from 15 to 20 percent of all women are sterile. In a few geographic areas of sub-Saharan Africa, sterility is high at all ages. Venereal disease, a probable major cause of these high levels of sterility, could, if treated, affect fertility. For the most part, however, changes in sterility will not have a significant impact on fertility rates in the next 20 years.

Past trends in fetal death rates from natural causes in more developed countries (MDCs) and expected health improvements in LDCs suggest that these rates will continue to decrease slowly, causing only slight increases in LDC live birth rates.

The duration of women's fertile period—the interval in the middle of the menstrual cycle during which ovulation occurs—is unlikely to change.

Natural fertility

If women were to begin childbearing at the start of their reproductive years (menarche) and to continue without interruption until they were no longer fecund (menopause), then, in the absence of limiting factors such as variations in frequency of intercourse, natural sterility, fetal mortality, and lactation, they could potentially have 30 to 40 children over their reproductive lives. But no known population—even those that have maintained high fertility goals—has ever reached this average. The highest fertility rate (total marital fertility rate) ever confirmed was for the North American religious sect known as the Hutterites—nearly 13 (table 10). More recently, Guatemala (1970-74) and Syria (1973) have recorded marital fertility rates of nearly 10 (table 11).

As groups desiring large numbers of offspring have been able to achieve fewer than half of the possible total per woman, natural limiting factors are clearly at work. Frequency of intercourse, natural sterility, natural fetal mortality, and duration of the fertile period reduce fertility from the potential level of 30 to about 15. To reduce fertility rates further to those actually observed in most populations, the most important limiting direct factors are: 1) lactation, 2) proportion married and age at marriage, 3) induced abortion, and 4) contraception (3).

Table 10.—Total Fertility Rate and Total Marital Fertility Rate for Selected Populations[a]

Historical populations	Total fertility rate	Total marital fertility rate
Bavarian Villages, 1700-1850	4.5[b]	11.9
Crulai, 1674-1742	5.6	9.9
Grafenhausen, 1700-1850	4.7[b]	10.7
Hutterites, 1923-1930	9.5	13.0
Ile de France, 1740-1779	6.1	12.1
Oschelbron, 1700-1850	5.1[b]	10.6
Quebec, 1700-1730	8.0	12.7
Tourouvre au Perche, 1665-1714	6.0	10.2
Waldeck Villages, 1700-1850	4.4[b]	9.9
Werdum, 1700-1850	3.8[b]	9.4

[a] The total marital fertility rate is higher because it is the fertility rate for married women only and reflects the depressant effect of proportion married on the actual fertility rate of the entire population.

[b] These figures are approximate.

SOURCE: J. Bongaarts, "The Fertility Inhibiting Effects of the Intermediate Fertility Variables," paper prepared for the IUSSP and WFS Seminar on the Analysis of Maternity Histories, London, April 1980.

Table 11.—Total Fertility Rate and Total Marital Fertility Rate for Selected Countries[a]

	Year	Total fertility rate	Total marital fertility rate
LDCs			
Bangladesh	1976	6.3	7.4
Colombia	1976	4.2	7.5
Guatemala (rural)	1970-74	7.0	9.7
Indonesia	1976	4.7	6.6
Jordan	1976	6.4	8.6
South Korea	1970	4.2	7.1
Panama	1976	4.3	6.8
Peru	1977	5.1	8.9
South Lebanon	1973	4.7	8.9
Sri Lanka	1975	3.5	6.9
Syria	1973	7.0	9.6
Turkey	1968	5.6	7.2
MDCs			
Denmark	1970	1.8	3.2
Finland	1971	1.6	3.1
France	1972	2.2	4.3
Hungary	1966	1.8	2.9
Poland	1972	2.1	4.8
United Kingdom	1967	2.4	3.9
United States	1967	2.3	3.7
Yugoslavia	1970	2.1	3.7

[a] The total marital fertility rate is higher because it is the fertility rate for married women only and reflects the depressant effect of proportion married on the actual fertility rate of the entire population. The rates exclude illegitimate births.

SOURCE: J. Bongaarts, "The Fertility Inhibiting Effects of the Intermediate Fertility Variables," paper prepared for the IUSSP and WFS Seminar on the Analysis of Maternity Histories, London, April 1980.

Primary determinants of changes in fertility rates

Lactation

Lactation has a contraceptive effect because it temporarily suppresses ovulation. When a mother breastfeeds, menses may not resume for as long as a year or more following birth. By contrast, women who do not breastfeed resume ovulation and menstruation 1 to 2 months after childbirth. In the absence of contraceptive use, the interval between successive births is 15 to 30 percent longer for women who breastfeed than for those who do not (8,17,18).

By significantly lengthening average birth intervals (the period between successive births) in populations, the practice of breastfeeding can lower fertility rates, but is an unreliable individual contraceptive method for two reasons. First, resumption of menses is extremely variable. On average, 1 month of amenorrhea is added for 2 months of breastfeeding. Women who breastfeed for 8 to 12 months can begin menstruating again 4 to 7 months after childbirth, and women who breastfeed for 2 years can resume menstruation from 7 to 20 months after the birth. Second, ovulation usually precedes the first menses, so a woman may become pregnant again before she realizes that she is fecund (capable of becoming pregnant) (18).

Most women in LDCs breastfeed their infants, but both the prevalence and duration of breastfeeding are declining. In Bangladesh, Nepal, Pakistan, Indonesia, and Kenya, more than 95 percent of women breastfeed. In other countries, most mothers still breastfeed, but percentages are lower: 85 percent in the Philippines, 81 percent in Malaysia, and 79 percent in Panama.

Women who are better educated and/or live in urban environments are less likely to breastfeed, and do so for shorter periods. In Malaysia, for example, 85 percent of rural women breastfeed, but only 62 percent of urban women do, and for half as long as their rural counterparts. And there is usually an inverse relationship between the mother's education and the length of breastfeeding. In Thailand, women with no education breastfeed for about 12.0 months on average, those with a primary education for 10.7 months, and those with a secondary or higher education for 7.8 months (9).

The practice of breastfeeding is accompanied by lengthy periods of postpartum abstinence in some LDCs, especially in Africa. This norm was virtually universal in sub-Saharan Africa during the 19th century, when in 55 percent of the 131 societies for which records are available the custom of abstinence was observed for longer than 13 months (14). As traditional cultural supports for these norms are breaking down, the overall contraceptive effect of breastfeeding and breastfeeding accompanied by abstinence is decreasing.

Where fertility rates are high, breastfeeding acts to prevent maximum fertility. For example, in the Philippines in 1973, it was estimated that the additional 5.5 months protection afforded to women who breastfed provided approximately 590,000 "couple years" of protection from pregnancy, nearly equaling the 600,000 couple years of protection provided to the then 2 million participants in the family planning program (4).

Age at marriage and proportion married

Because most births take place within some form of relatively stable union in most LDCs, age at marriage and proportion married have a significant impact on fertility. In the absence of premarital sexual activity, a woman who marries at a later age is exposed to the possibility of pregnancy for fewer years.

Later age at marriage can also have an impact on population growth even when the number of children is the same for later marrying women as for those who marry at younger ages. Increasing age at marriage shifts births from one age group and time period to a later one, temporarily lowering the birth rate. Although this increase in age at marriage cannot be repeated once it has taken place, its effects continue. For example, when other factors are equal, a family in which all women marry at age 15 and produce daughters every 5 years until age 40 will have more than five times as many living members after a period of 60 years than a family in which all women marry at age 25 and also produce daughters every 5 years until age 40 (see Technical Note C). This substantial difference occurs because women married at age 15 would average five children apiece in 60 years, whereas women married at age 25 would average only three children apiece in the same period.

Photo Credit: Agency for International Development

Many women in LDCs become mothers while in their teens

In many countries, both rising age at marriage and contraceptive use have contributed to fertility decline. Table 12 lists 26 of the 80 LDCs of more than 1 million population where data are available on fertility and marriage trends. Of the 80 countries, only these 26 have also experienced appreciable fertility declines. The 13 indicated by the letter "a" already record high ages at marriage (in Taiwan and Korea, fewer than 10 percent marry before age 20). In seven of these countries (marked a and b), fertility among women 15 to 19 or 20 to 24 has dropped significantly, confirming the impact of higher age at marriage on fertility. In the other countries, substantial declines in fertility have occurred even though age at marriage has not

Table 12.—Twenty-Six LDCs Where There Have Been Appreciable Declines in Fertility and for Which Data on Fertility Trends and Marriage Trends Are Available

East Asia
China[a]
Hong Kong[a,b]
South Korea[a]
Taiwan[a]

Southeast Asia
Indonesia[a,b]
Malaysia[a,b]
Philippines[a,b]
Singapore[a,b]
Thailand

Indian Subcontinent
India[a]
Sri Lanka[a,b]

Middle East
Iran[a]
Tunisia[a,b]
Turkey[a]

Latin America
Brazil
Chile
Colombia
Costa Rica
Cuba
Dominican Republic
El Salvador
Jamaica
Panama
Peru
Trinidad and Tobago
Venezuela

[a] Recent increases in age at marriage or age at marriage already high.
[b] Declining fertility among women 15-19 or 20-24 (additional confirmation of higher age at marriage); the remainder have experienced substantial declines in fertility even though age at marriage has not increased recently.

SOURCE: From Henry and Piotrow, 1979, "Age at Marriage and Fertility," *Population Reports*, Population Information Program, Johns Hopkins University, series M, vol. 4, November 1979.

risen. Fertility in women 15 to 19 or 20 to 24 has fallen appreciably in Brazil, the Dominican Republic, El Salvador, Panama, Peru, Trinidad and Tobago, and Venezuela (7). But as patterns of marriage in these countries make age at first marriage difficult to define, how much of the decline in fertility is due to rising age at marriage and how much to increased contraceptive use is unclear.

Age at marriage is influenced by the sociocultural context in which marriage takes place. In China, Sri Lanka, and Tunisia, age at marriage has risen and fertility has declined, but for very different reasons.

CHINA

In the People's Republic of China (PRC), where the government has embarked on a major campaign to slow population growth, young people are now expected to defer marriage well beyond the minimum legal ages of 18 for women and 20 for men. In the cities, the norms for age at marriage are 24 for women and 26 for men; their rural counterparts may marry at the slightly earlier ages of 23 and 25, respectively (5).

The effectiveness of the Chinese emphasis on delayed marriage and increased opportunities for women is shown in data from Shanghai, where there has been an increase in age at marriage of 5 to 7 years since 1950 (table 13).

Later age at marriage is helping to reduce fertility in the PRC, but age composition and population momentum play significant roles in the country's continuing population growth. Despite China's lowered birth rate and a contraceptive prevalence rate as high as 84 percent in some regions, the sharp rise in numbers of women who will enter the marriageable ages in the 1980's—due to high levels of fertility during the past 20 years—will make the country's population goals difficult to achieve. As this strong momentum for future growth is inherent in China's age composition, the government is taking steps to curb third (and higher) births by 1985 and is moving toward a one-child family norm (table 14).

SRI LANKA

In Sri Lanka, 63 percent of the decline in birth rates between 1963 and 1971 is attributable to changing patterns of marriage in the absence of a government policy designed to encourage such change. Age at marriage has risen as a result of:

- Continuing adherence to cultural practices. Prospective mates are expected to be of the same caste and ethnic group; elaborate procedures are undertaken to assure that the

Table 13.—Mean Age at Marriage for Women in Shanghai 1950 to 1979

Period of marriage	City proper	Suburban county
1950-54	19.9	19.8
1955-59	24.9	20.6
1960-64	26.3	23.9
1965-69	26.6	24.1
1970-74	26.8	24.6
1975-79	27.9	25.0

SOURCE: Gu Xingyvan discussion at WFS Conference, London, July 1980.

Table 14.—Women Expected to Reach Marriage Age, China, 1980-2000

Year	As percent of 1980		Year		As percent of 1980
1980	100		1990	High fertility rates	136
1981	87	Born during the "Bitter Years" of famine and high infant mortality	1991		130
1982	70		1992		134
1983	79		1993		126
1984	130	High fertility rates	1994		118
1985	158		1995		108
1986	135		1996	Lower fertility rates evident from mid-1970's onward	88
1987	133		1997		85
1988	123		1998		96
1989	120		1999		90
			2000		90

NOTE: The proportion of women entering the marriageable ages from 1980 to 2000, which is expressed as a percentage of the number of women of marriage age in 1980, illustrates the effect of the built-in momentum of population growth even when ~~fertility~~ rates are declining rapidly. The PRC has been able to realize a significant reduction in birth rates in the past 5 years because relatively fewer women were born during the "Bitter Years" of the late 1950's and early 1960's, or survived this period to reach reproductive age. Due to renewed high fertility in subsequent years, there will be a substantial increase in the absolute number of women entering the marriageable ages (see also fig. 2B illustrating the U.S. "Baby Boom") until 1996, when the effects of declining fertility in the latter half of the 1970's will be felt. This high potential fertility is a major factor in the PRC's decision to promulgate the one-child family norm.

SOURCE: Liu Zheng, "March Toward Zero Population Growth," *Sichuan University Journal* (Philosophy and Social Science Edition), 1980, No. I, p. 13.

two horoscopes are compatible: the bride must be a virgin: the groom must be older, and his potential job security and the dowry provided by the young woman and her family must be acceptable.

- Increasing economic and job opportunities for women. In 1971, 71 percent of Sri Lankan women were literate, and 26 percent were in the labor force.
- A stagnating economic climate. Employment is difficult to obtain, agricultural land shortages have intensified, and males have migrated, leading to
- "Marriage squeeze," a sex ratio imbalance among those in traditional marriageable ages. In 1974 there were 75 males aged 25 to 34 for every 100 females aged 20 to 30 (1).

TUNISIA

In Tunisia, both government intervention and unanticipated economic changes have contributed to rising age at marriage. Age at marriage has risen as a result of:

- Marriage squeeze. In 1975, there were 77 males ages 20 to 24 for every 100 females ages 15 to 19, and 58 males ages 25 to 29 for every 100 females ages 20 to 24. Tunisian men are migrating to Europe and to other Arab countries to seek employment.
- A minimum age at marriage law passed in 1964 set the minimum age at marriage at 17 for women and 20 for men. An antipolygamy law passed in 1956 also guaranteed a voice in marriage decisions and other legal rights to Tunisian women.
- Committed leadership. President Bourguiba has made a strong commitment to the emancipation of women.
- Increased educational and job opportunities for women. By 1971, female literacy had reached 40 percent, and 7 percent of Tunisian women had entered the labor force (1).

When contraceptive use becomes extensive, age at marriage will lose importance as a causal mechanism in fertility change. Nevertheless, age at marriage will continue to be an important factor for the next 20 years, because of the number of people entering the marriageable ages in LDC populations:

> During the 1980's and 1990's, there will be more young adults in their peak reproductive and marriageable years (age 15 to 29) than ever before in history. More than 40 percent of the

people in developing countries today are under 15 years of age. By 1990, there will be 40 percent more potential parents age 15 to 29 than there were in 1975, and more than twice as many as in 1960—in other words, a total of more than 1 billion potential husbands and wives, fathers and mothers. If this new generation marries young and then begins to reproduce at an early age, it will be difficult for many countries to reduce population growth to desired levels even if marital fertility is sharply reduced (7).

Induced abortion

Biological events such as life and death are culturally defined. For example, in some cultures, a child is not considered "born" until its naming ceremony, which can take place as long as a month after the child's birth. Where neonatal mortality rates are high, various "neglect" behaviors are rationalized. In the view of those societies, if the child hasn't been "born" yet, then it didn't "die." Although cultural and ethical issues are inexorably entwined in any discussion of induced abortion, it is a direct means of fertility regulation, and certain facts pertaining to abortion can be analyzed separately from ethical issues.

An estimated 55 million abortions are performed throughout the world each year, or about 70 abortion procedures for every 1,000 women of reproductive age. More than half of these occur in LDCs (10,16).

In 1980, 9 percent of the world's population lived in countries where induced abortion was illegal. An additional 19 percent lived in countries where the procedure was officially permitted only to save a woman's life. Some 10 percent lived in countries authorizing abortion on broader medical grounds, and an additional 24 percent lived where social factors were also considered. The largest group—38 percent—lived in countries where induced abortion during the first trimester of pregnancy was legal and available at the request of the pregnant woman (16).

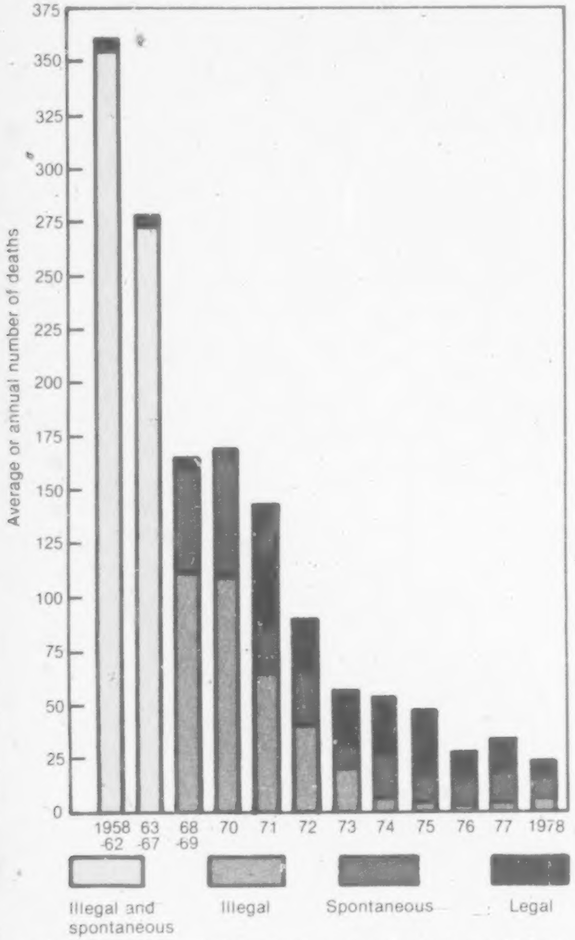
Changes in abortion laws over the past 15 years have taken place for four reasons: 1) public health, to combat the maternal mortality and morbidity associated with illegal abortion; 2) social justice, to give poor women the access to induced abortion previously available only to wealthier women; 3) women's rights, to provide women greater control over their reproductive lives; and 4) in a few countries (China, Singapore) government population policies, to encourage women to utilize the procedure in the event of contraceptive failure.

In the United States, the 1978 abortion rate as reported by the Center for Disease Control was 23 per 1,000 women of reproductive age. New estimates of induced abortion in China place that country's rate at 25 in 1978. Eastern bloc countries have very high rates. In the U.S.S.R., there were 180 abortions per 1,000 women of reproductive age in 1970, the latest year for which data are available. There were 88 abortions per 1,000 women of reproductive age in Romania and 68 per 1,000 for the same group in Bulgaria (1979). The latest data from Japan (1975) show an equivalent rate of 84 per 1,000 (16).

In countries where induced abortion is illegal, maternal mortality from complications of improperly performed procedures can be as high as 1 in 100 procedures (16). When abortion is performed during the first trimester under medically supervised conditions, maternal mortality rates are very low. (In the United States in 1978, 11 times more women died as a result of pregnancy and childbirth than as a result of legal abortions). In the United States, where changes in abortion laws to allow more legal abortions began in 1967, maternal mortality from abortion (spontaneous and induced) fell at a rate of 18 percent per year from 1968 to 1978. Maternal deaths attributed to illegal abortions declined 34 percent per year during the same period (16) (fig. 7).

Induced abortion occurs in all societies, whether legislation permits it or not. The frequency of abortion procedures can often be reduced by making effective contraceptive methods readily available. The introduction of contraceptives can also reduce the maternal mortality that accompanies illegal abortions. This was the justification for establishing official family planning programs in Chile. A survey

Figure 7.—Number of Deaths Associated With Abortion, by Type of Abortion: United States, 1958-78



SOURCE: C. Tietze, *Induced Abortion: A World Review, 1981*, Population Council, 4th ed.

taken in the early 1960's, when these efforts began, found that at least 25 percent of women in Chile acknowledged having had an illegal abortion. Between 1964 and 1978, the number of women of reproductive age using contraceptives increased from 3 to 23 percent. During the same period, the number of women admitted to hospitals for complications from illegal abortions declined from more than 56,000 to 37,900. Mortality among women undergoing illegal abortion also decreased markedly, from 11.8 per 10,000 live births to 4.2 per 10,000 live births (10).

Although induced abortion can be an effective method of fertility regulation for an individual because it prevents a live birth, it is not an "efficient" way for a society to reduce the total number of births. If an average couple in an MDC were not practicing contraception and the woman did not breastfeed the infant, the couple could have a live birth about 17 months after the previous birth (2 months of postpartum infertility, plus 6 months—the average time to become pregnant—plus 9 months of pregnancy) (fig. 8). If the woman breastfeeds, the birth interval could be 27 months on average because lactation would increase the infertile period by about 10 months. Using induced abortion (after 2 months of pregnancy) as a fertility planning method shortens the pregnancy interval because 7 months of pregnancy and 1 to 11 months of postpartum infertility are interrupted. The period between induced abortions is about 9 months (1 month of postpartum infertility, plus 6 months to become pregnant again, plus 1 or 2 months of pregnancy before another induced abortion interrupts the pregnancy).

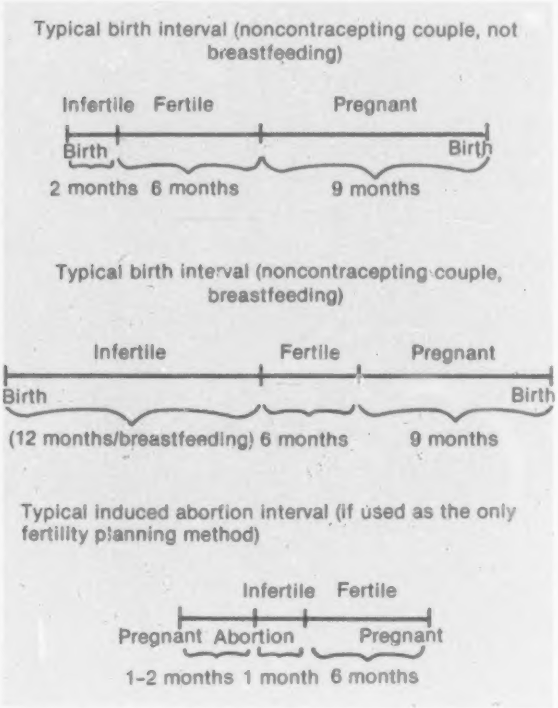
On average, if a woman wished to have two children (replacement fertility) rather than, say, seven (the average number in some LDCs today), and used abortion as her sole fertility planning method, she could expect to have about 9 to 10 induced abortions during her reproductive years (i.e., two abortions for each full-term birth averted). The number of induced abortions would be still higher were there no changes in natural sterility with age, divorce, widowhood, coital frequency, etc. (12,13,16).

Contraception

Contraceptive prevalence rates are reliable predictors of crude birth rates despite the effects of the other factors that directly affect fertility rates. In figure 9, the line relating the contraceptive prevalence rate and the crude birth rate 1 year later indicates that every 2.4-percentage-point increase in contraceptive prevalence (X-axis) is associated with a 1-point decline in the birth rate (Y-axis) (11).

Knowledge of the relationship of various factors with the use of contraception is increasing

Figure 8.—Birth Intervals and Induced Abortion


Typical birth interval (noncontracepting couple, not breastfeeding)
Infertile
Fertile
Pregnant
Birth
Birth
2 months
6 months
9 months
Typical birth interval (noncontracepting couple, breastfeeding)
Infertile
Fertile
Pregnant
Birth
Birth
(12 months/breastfeeding)
6 months
9 months
Typical induced abortion interval (if used as the only fertility planning method)
Infertile
Fertile
Pregnant
Abortion
Pregnant
1-2 months
1 month
6 months

SOURCE: Office of Technology Assessment.

rapidly, as illustrated by the following examples of the relationships between contraceptive use and place of residence, age, and education.

Contraceptive prevalence rates tend to have similar patterns in geographic regions. Contraceptive practice is relatively high in Southeast Asia and in Latin America, low in Middle South Asia, and lowest in Africa.

The proportion of couples using particular contraceptive methods differs widely among countries (table 15 and figs. 10, 11, and 12). The causes of these differences include cultural factors, the strength and historical antecedents of the program effort, the methods available in the country, and the socioeconomic setting. Fifty-seven percent of women who use contraceptives in Indonesia (Java and Bali), a relatively poor country, use oral contraceptives. Orals require fewer personnel with less medical support than other methods such as IUDs and sterilization. Oral contraceptive use is also high in Malaysia (44 percent of contraceptive users), Colombia (42 percent), and Mexico (31 percent) IUDs are used by far fewer women in all countries except China; Colombia (16 percent) and Korea (20 percent) have relatively high proportions of IUD users, while IUD use is now estimated by China's State Council Birth Planning Staff Office to account for about 50 percent of all contraceptive use in that country.

As a result of early marriage, in many LDCs the majority of women have all the children they want by age 25 yet face the possibility of pregnancy for 20 more years. Thus demand for sterilization is increasing in these countries, and because simpler techniques that allow paramedical personnel to perform the procedure have been developed, many women and men elect this as an efficient means to terminate childbearing. About 87 percent of India's contraceptive use rate in 1979 was attributable to sterilization. In Thailand, a concentrated effort to increase the availability of sterilization services markedly changed the country's contraceptive use rate in just 2 years. A significant portion of the increase in overall contraceptive use in Colombia is also attributable to an increase in male and female sterilization: sterilization accounted for 9.4 percent of all contraceptive use in 1976 and 17 percent of all use by 1978.

Contraceptive use varies with age and with the number of children a woman has. Except for Bangladesh, Pakistan, Kenya, and Nepal, of the countries shown in table 15, 40 percent or more of women with four children are using contraception. In many countries, contraceptive use decreases when women have five or more children. This may be due to the fact that older women may resist the adoption of family planning or may believe they are no longer capable of bearing children. Older women who do use contraception are more likely to use more efficient methods, especially sterilization where it is available.

Rural-urban differences in contraceptive use follow the same pattern in all countries: a higher percentage of urban women use contraception. This difference is based on both personal

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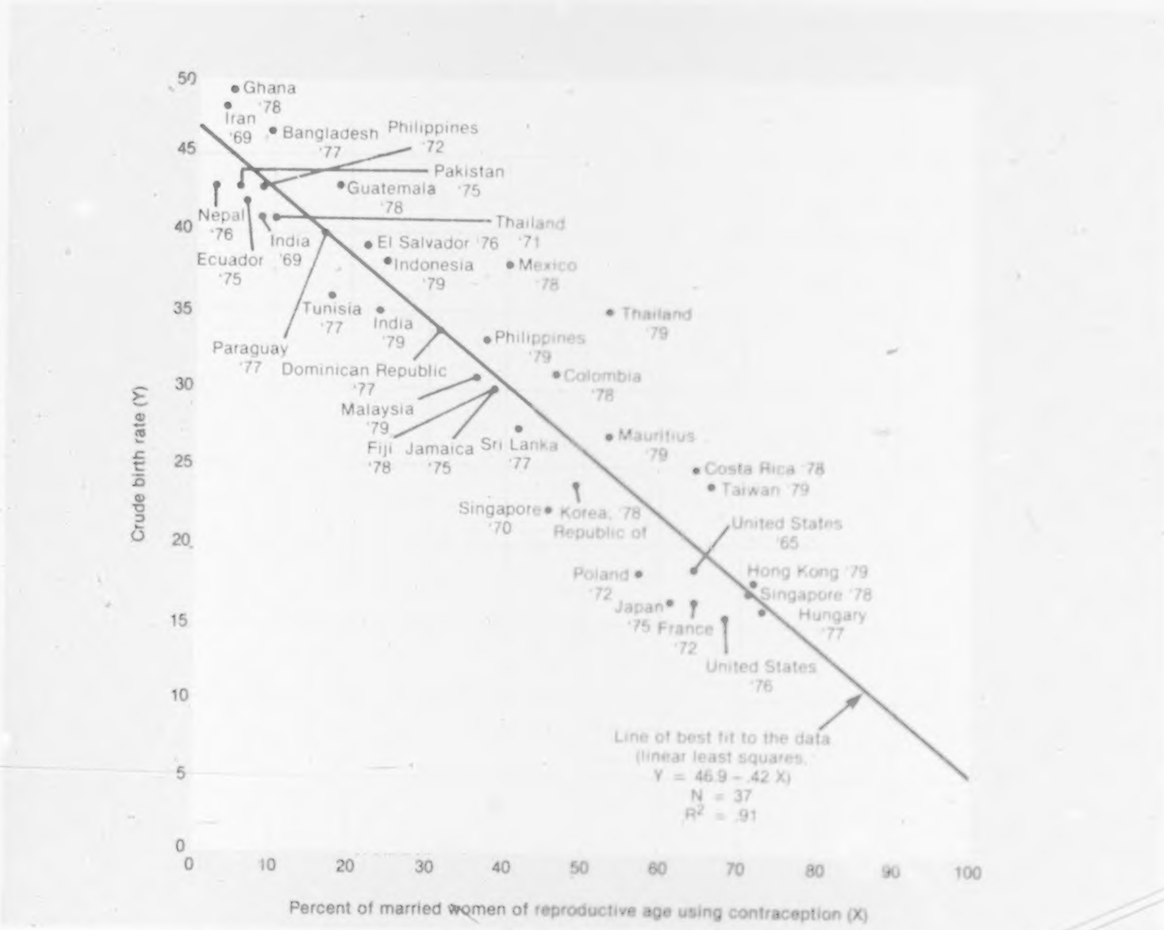
Figure 9.—Contraceptive Prevalence Rates Among Married Women of Reproductive Age and Crude Birth Rates 1 Year Later



SOURCE: D. Nortman and E. Hofstatter, *Population and Family Planning Programs: A Compendium of Data Through 1978*, Population Council, 10th edition.

Table 15.—Contraceptive Prevalence by Method in Selected Countries

	Source	Year	Age	MWRA total prevalence	Barrier	Sterilization	IUD	Orals/ injection	Other
Asia									
Bangladesh	WFS	1975	15-49	8	[a]	0.8	0.5	2.9	3.8
	CPS	1979		11	1.3	3.0	0.2	3.5	3.0
China[b]	Chen	1980	15-44	70	4.0	21.0	35.0	8.0	2.0
India[b]	Government	1979	15-44	23	—	20.1	0.9	—	1.6
Indonesia (Java & Bali)..	WFS	1976	15-49	26	—	0.3	5.5	14.8	5.5
South Korea	WFS	1974	15-49	35	—	4.9	8.1	8.8	13.3
	FPS	1978	20-44	49	—	16.2	9.8	6.4	16.7
	CPS	1979	15-44	55	5.2	20.4	9.6	7.2	12.1
Malaysia	PC	1969	15-44	6	—	0.3	0.1	5.5	0.1
	WFS	1974	15-49	35	—	7.0	0.7	15.4	11.9
Nepal	WFS	1976	15-49	2	—	1.4	0	0.3	0.3

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Table 15.—Contraceptive Prevalence by Method in Selected Countries (Continued)

	Source	Year	Age	MWRA total prevalence	Barrier	Sterilization	IUD	Orals/ injection	Other
Pakistan	WFS	1975	15-49	5	—	1.0	0.6	1.0	2.5
Philippines	PC	1972	15-44	8	—	0	1.8	4.9	1.3
	WFS	1977	15-44	36	3.5	5.4	2.3	4.7	20.2
Sri Lanka	WFS	1975	15-49	33	—	10.2	5.0	2.0	15.8
Thailand	WFS	1975	15-49	33	—	7.9	5.9	15.5	3.6
	CPS	1978	15-49	53	2.2	16.5	4.0	26.6	4.1
Latin America									
Colombia	WFS	1976	15-49	42	—	3.9	8.4	13.4	16.0
	CPS	1978	15-44	46	—	7.8	7.4	17.0	13.8
Guatemala	CDC	1978	15-44	18	—	6.3	1.3	5.4	5.0
Mexico	WFS	1976-77	15-49	30	0.7	2.9	5.7	12.5	8.2
	CPS	1978	15-49	40	1.0	7.1	6.5	16.6	8.8
	CPS	1979	15-49	38	0.8	9.1	6.1	15.0	7.0
Peru	WFS	1977-78	15-49	34	1.1	2.8	1.5	5.7	22.4
Brazil	CDC								
Sao Paulo		1978	15-44	64	6.6	16.1	—	27.8	13.4
Piaui		1979	15-44	31	—	15.4	—	10.0	5.4
Africa/Middle East									
Egypt[b]	Government		?	20	0.3	0	1.7	16.5	1.1
Kenya	WFS	1977-78	15-49	9	—	1.3	0.9	3.4	3.6
MDCs									
United Kingdom	WFS	1976	16-49	75	—	16.0	6.0	25.0	30.0
France	WFS	1978	20-44	79	—	4.7	9.5	30.8	34.0
United States	WFS	1976	15-44	68	—	19.0	6.1	22.4	20.4

[a] Barrier is often included in other category

[b] Government programs only

MWRA - Married women of reproductive age.

WFS - World Fertility Survey of International Statistical Institute.

CPS - Contraceptive Prevalence Survey of Westinghouse Health Systems.

Chen - From Office of Technology Assessment Contractor Report of Pi-Chao Chen.

PC - Population Council.

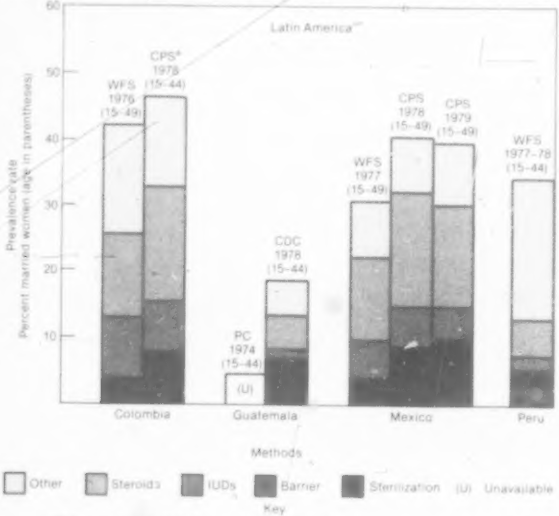
CDC - Center for Disease Control Survey.

FPS - Family Practice Survey of Korean Institute for Family Planning.

SOURCE: Office of Technology Assessment.

factors and on the availability of contraceptive methods. In many countries family planning programs effectively reach only urban women. In Pakistan, for example, 15 percent of urban women but only 3 percent of rural women are currently using contraception. Yet the country's population is predominantly rural—74 percent of Pakistanis live in rural areas. In Bangladesh, where the population is 91 percent rural, 23 percent of urban women use contraception but only 9 percent of those in rural areas do so. In Indonesia (Java and Bali), which is 82 percent rural, a deliberate goal of the family planning program has been to reach women in the countryside. Here the difference is less extreme: 40 percent of urban women are contraceptive users as compared with 36 percent of rural women. Where government programs make no special effort to reach rural couples, socioeconomic factors such as educational level and income substantially influence contraceptive use, but where governments provide services in rural areas, the influence of these factors becomes less important.

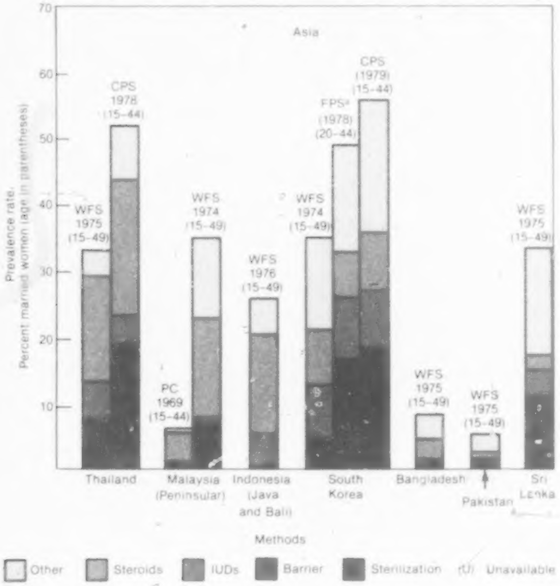
Figure 10.—Contraceptive Prevalence in Selected Countries Over Time by Method Mix, Latin America



SOURCE: Office of Technology Assessment.

Women who have more education are more likely to use contraceptives. It should be noted, however, that few women in these populations achieve even a secondary education. Thus, the high rates observed in the better educated groups often represent only a small minority of women in the country.

Figure 11.—Contraceptive Prevalence in Selected Countries Over Time Method Mix, Asia



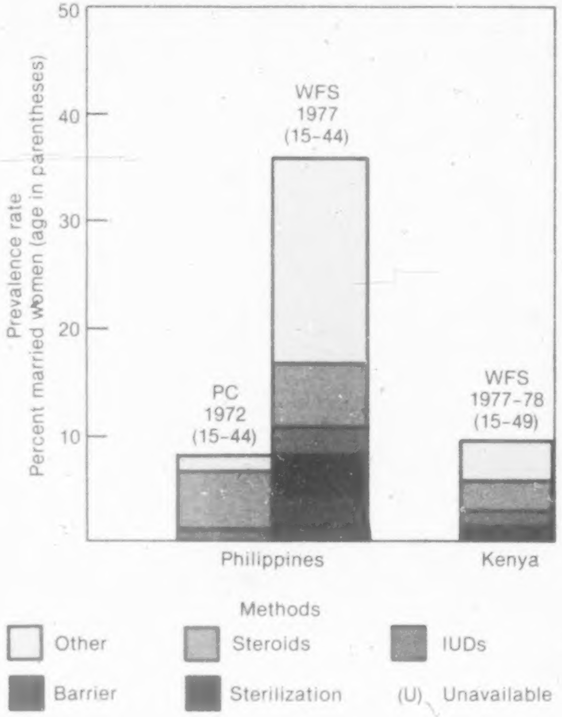
Key

WFS — World Fertility Survey (Int'l. Statistical Institute)
CPS — Contraceptive Prevalence Survey (Westinghouse Health Systems)
CDC — Center for Disease Control Survey
PC — Population Council

aFPS: Family Practice Survey—carried out by Korean Institute for Family Planning.

SOURCE: Office of Technology Assessment.

Figure 12.—Contraceptive Prevalence in Selected Countries Over Time by Method Mix, Philippines and Kenya



Key

WFS — World Fertility Survey (Int'l. Statistical Institute)
CPS — Contraceptive Prevalence Survey (Westinghouse Health Systems)
CDC — Center for Disease Control Survey
PC — Population Council

SOURCE: Office of Technology Assessment.

Relative effects of the direct determinants on fertility rates

What is the role of these direct factors in fertility change and why are some more important than others? A useful way to evaluate these factors is to examine their fertility-inhibiting impact in recent years in terms of the maximum number of children women would have if these factors were not present.

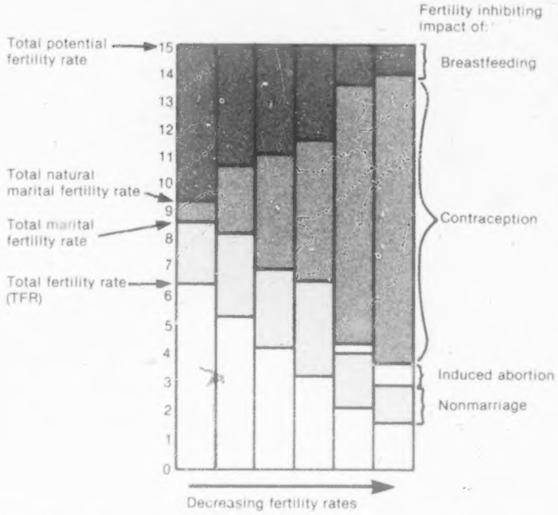
A maximum fertility rate of almost 13 is the highest ever recorded in a human population. High fertility rates prevail in populations where there is little marital disruption due to divorce or death, limited duration of breastfeeding, little induced abortion, and no contraceptive use. The total fertility rate, usually much lower than the maximum of 13, is the rate actually measured in populations and reflects the effects of these fertility inhibiting factors. If only married people are counted, the rate is higher than the total fertility rate and is called the total marital fertility rate. If the inhibiting effects of contraception and induced abortion are removed, fertility would rise to the total natural fertility rate. And, finally, if the inhibiting effect of breastfeeding is removed, fertility would rise to the maximum: about 15 births per woman on average.

These relationships are summarized in figure 13. The vertical axis represents fertility rates, and the partitions represent the contributions of each of the four primary factors in lowering the potential rate. The horizontal axis represents successively smaller total fertility rates (the white partition in each column) down to below replacement levels. This figure illustrates the relative importance of each fertility-inhibiting factor as replacement fertility levels are approached.

Figure 14 summarizes the historical contribution of each of the fertility inhibiting factors as population fertility rates have changed. When fertility rates are high, breastfeeding is found to have a significant impact, reducing potential fertility by 37 percent. At replacement levels of fertility, however, breastfeeding is not significant, contributing only 7 percent of the inhibiting effect on the total fertility rates (fig. 14).

By contrast, the fertility-inhibiting effect of the other factors has been found to increase as fertility approaches replacement levels. The effect of proportions not married (later age at marriage) rises from 25 to 47 percent as total fertility rates fall. Induced abortion is insignificant when total fertility rates are above 3 but has some impact when these rates are at replacement levels.

Figure 13.—Fertility-Inhibiting Impact of Selected Factors

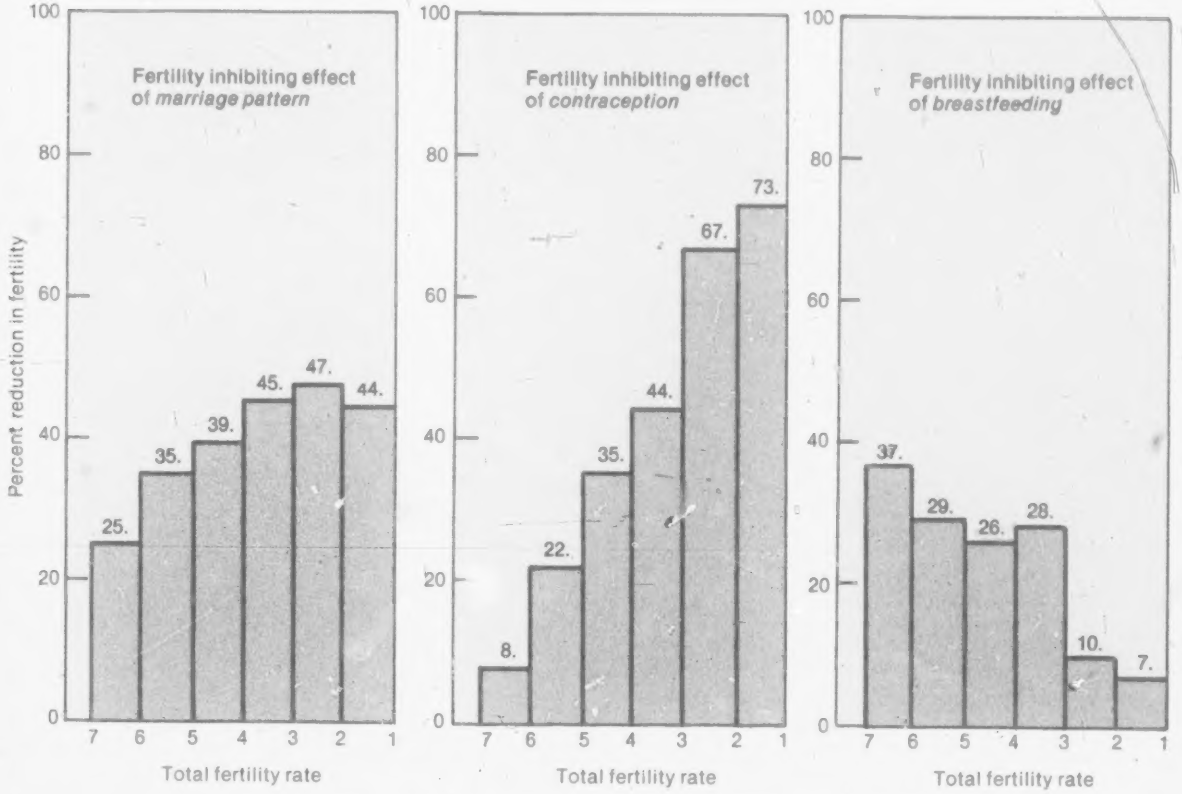


SOURCE: J. Bongaarts, "The Fertility Inhibiting Effects of the Intermediate Fertility Variables," paper prepared for the IUSSP and WFS Seminar on the Analysis of Maternity Histories, London, April 1980.

The pattern of the fertility-inhibiting effects of these variables changes slightly when different countries are used in calculating the rates. For example, because Eastern European countries were included with LDCs and other MDCs in this analysis, induced abortion was shown to have a significant impact at replacement levels. (Eastern European countries have total fertility rates at or below replacement levels and induced abortion is used extensively.) In populations with higher total fertility rates and similar rates of induced abortion, the demographic effect of induced abortion may be more significant than shown here.

The demographic transition in Europe was a relatively slow process by comparison with the current transition in LDCs, and the effects of these four direct factors—proportions married and age at marriage, contraceptive use, induced abortion, and lactation—were different in the relative degree of their impact on declines in total fertility rates. Today, however, the finding that contraception has a markedly intensified capability to reduce potential fertility as total fertility rates approach replacement levels is particularly important. Contraceptive use has

Figure 14.—Fertility Inhibiting Effects of Marriage Patterns, Contraception, and Breastfeeding



NOTE: Percent reduction in fertility caused by late marriage, divorce, or death; contraception; and breastfeeding in groups of populations with declining total fertility rates.

SOURCE: J. Bongaarts, "The Fertility Inhibiting Effects of the Intermediate Fertility Variables," paper prepared for the IUSSP and WFS Seminar on the Analysis of Maternity Histories, London, April 1980.

been found to contribute only 8 percent of the inhibiting effect at high total fertility levels but 73 percent when replacement rates are approached (2). Thus, of all of the factors that directly determine total fertility rates, contraceptive use has been established as of unique importance in achieving replacement fertility.

Technical Note A: The demographic transition[1]

The shift from high to low fertility known as the demographic transition is accompanied by vast social changes and has long intrigued social scientists. Based on the apparent experience of Western Europe, a general "theory of the demographic transition" was developed, which held that fertility decline follows only after, and as the result of, a decline in mortality (particularly infant mortality) and improvement in socioeconomic conditions, or "modernization." Because much of Europe's fertility decline took place before modern contraceptives or safe medical

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[1] John Knodel and Etienne van de Walle examine the European Demographic Transition in detail in "Lessons From the Past: Policy Implications of Historical Fertility Studies," *Population and Development Review*, vol. 5, No. 2, June 1979; and "Europe's Fertility Transition: New Evidence and Lessons for Today's Developing World," *Population Bulletin*, vol. 34, No. 6 (Washington, D.C.: Population Reference Bureau, Inc., 1980), from which this description draws heavily.

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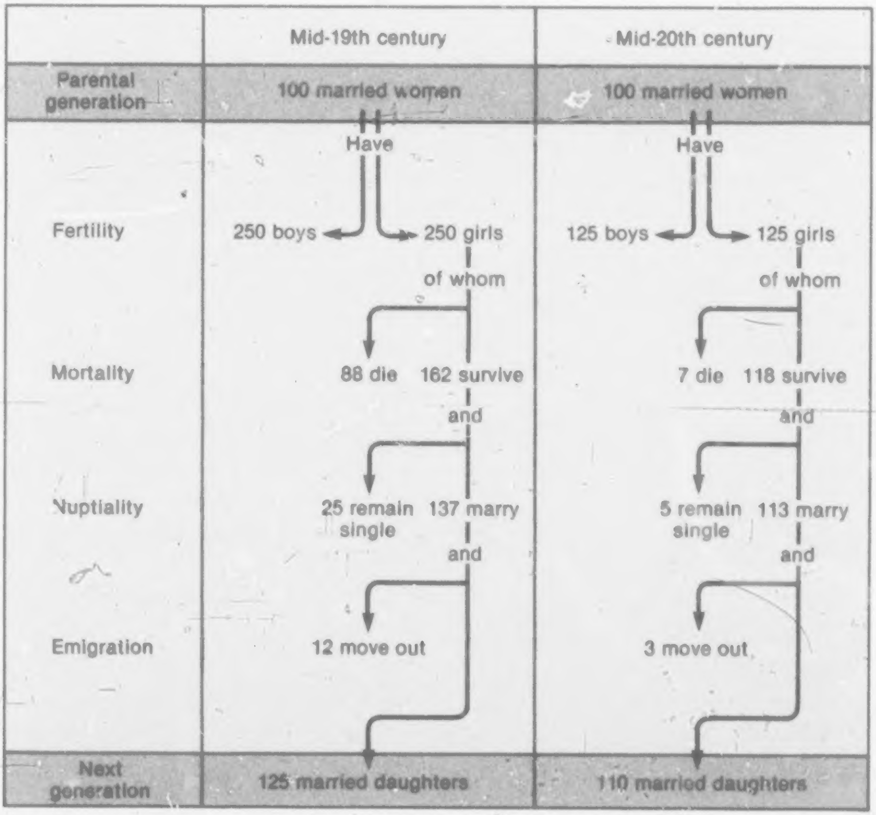
abortion were readily available, it is argued that couples who limited their family size must have done so by practicing withdrawal or abstinence. Induced abortion was rarely resorted to because of the dangers associated with the procedures then in use.

The demographic record has now been examined more closely. New information sources and analytical methods indicate that sustained fertility declines in Europe began under a much wider variety of social, economic, and demographic conditions than had been thought, appeared to follow cultural and linguistic lines, were remarkably concentrated as to onset—mostly between 1880 and 1910—and became irreversible processes once under way. Large families were not necessarily desired in pretransition Europe, according to these new findings, and high infant and child mortality may have been partly the result of high fertility rather than the other way around. The then-available fertility planning methods—withdrawal, abstinence, and induced abortion—may not have been used because they were unthinkable for married couples, ineffective, or simply unknown.

The European demographic transition can be visualized by contrasting the typical childbearing experiences of 100 women married in the middle of the 19th century with those of a similar group at mid-20th century (fig. 15). Much of 19th century Europe's high fertility was neutralized by high mortality, patterns of delayed marriage, and lifetime celibacy. Because of late marriage and widowhood, mothers averaged only five children apiece, a number well below their potential total. By the mid-20th century, a substantial decline in fertility reduced the number of children per family, but the likelihood that these offspring would survive to reach childbearing age had risen to almost 95 percent. Relatively more of

Figure 15.—Typical Demographic Patterns in Western Europe: Mid-19th and Mid-20th Centuries



Mid-19th century
Mid-20th century
Parental generation
100 married women
100 married women
Have
Have
Fertility
250 boys
250 girls
125 boys
125 girls
of whom
of whom
Mortality
88 die
162 survive
7 die
118 survive
and
and
Nuptiality
25 remain single
137 marry
5 remain single
113 marry
and
and
Emigration
12 move out
3 move out
Next generation
125 married daughters
110 married daughters

SOURCE: E. van de Walle and J. Knodel, "Europe's Fertility Transition: New Evidence and Lessons for Today's Developing World," *Population Bulletin*, vol. 34, No. 6, Population Reference Bureau, Inc., Washington, D.C. 1980.

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these surviving daughters were likely to marry and fewer to emigrate. The net result was a 10-percent gain in population over a generation in contrast to a gain of 25 percent a century earlier.

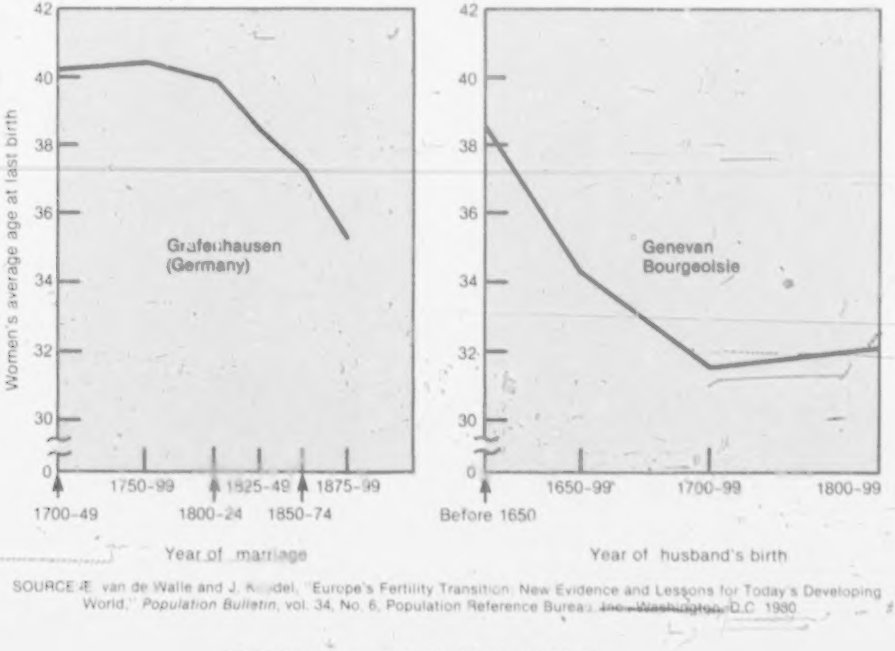
Information on these occurrences has been drawn from three principal sources: censuses, parish registers, and contemporary accounts. Family histories are reconstructed from parish registers, compared with censuses where available, and analyzed by new techniques. Contemporary accounts of socioeconomic conditions are then used where possible to confirm the results.

The concepts of natural fertility and family limitation are central to descriptions of the demographic transition. "Natural" fertility occurs among couples who make no attempt to limit or terminate childbearing during the biological reproductive lifespan. Family limitation describes couples who make a deliberate effort to terminate childbearing once a desired number of offspring have been born. Such limitation is not synonymous with "birth control" but refers instead to behavior designed to halt childbearing altogether. Birth control, or family planning, refers to spacing *and* limiting the total number of births. Birth spacing can occur under conditions of natural fertility, as when couples deliberately space births but are unconcerned with their total number. This practice has been common in sub-Saharan Africa, where it persists in many regions. The techniques used to study historical data can detect stopping behavior but cannot detect deliberate spacing behavior. This is important because the introduction and spread of stopping behavior characterized the onset of the fertility transition.

Because the decline in fertility in Europe resulted from a shift from natural fertility to family limitation, the age of women at last birth becomes an index for the degree of family limitation behavior being practiced. These trends are seen in two cultural groups in figure 16. The transition from natural fertility to family limitation began relatively early in the town of Grafenhausen, Germany. The bourgeoisie of Geneva, Switzerland, were an elite group who began practicing family limitation early in the 17th century, long before most other European couples did so. In both groups the shift is clearly evident: before the fertility decline, women had their last birth at about 40 years of age; toward the latter part of the decline they gave birth for the last time nearer 30 years of age.

In general, although predecline levels of fertility remained relatively constant within cultural or geographic areas, there was considerable variability in fertility levels among groups, due to a mix of physiological factors, social customs, health conditions, and differences in breastfeeding patterns. Evidence is strong that, despite regional differences in overall

Figure 16.—Trends in Average Age of Women at Last Birth: Grafenhausen and Genevan Bourgeoisie, 17th-19th Centuries



SOURCE: E. van de Walle and J. Knodel, "Europe's Fertility Transition: New Evidence and Lessons for Today's Developing World," *Population Bulletin*, vol. 34, No. 6, Population Reference Bureau, Inc., Washington, D.C. 1980.

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levels, fertility levels remained high and relatively constant until the decline began. The decline then, in all cases, became irrevocable, taking the same path in all areas and differing only in pace.

Indigenous methods of birth control, which have always been available in traditional societies, were available to married couples in pretransition Europe for the termination of childbearing if this had been their choice; there are references to methods of contraception and induced abortion in many cultural contexts. There is evidence that women in the late 19th and early 20th century, after the decline had begun, were ingesting a variety of substances in efforts to induce abortions. Because about 20 percent of known pregnancies end in spontaneous abortion, at least 20 women of 100 using a particular potion could "succeed" in such efforts despite the ineffectiveness of substances then in use. The practice of withdrawal as a method of family limitation is considered to have been little known until the period of the demographic transition, and the idea of family limitation was generally deemed impractical or even scandalous before this period.

The relationship between infant mortality and fertility is a component of fertility decline, in that high fertility (in Europe in the past and in LDCs today) is often viewed as an adaptation to high infant mortality. However, the evidence from European village studies shows that couples whose children all survived continued childbearing just as long as those who had lost offspring. Contemporary observers noted that deaths of children were often welcomed because they provided relief from the burdens of parenthood. In England, smallpox was commonly called "the poor man's friend." This evidence suggests that women continued bearing children because they had few alternatives.

Abusive child care practices and general child neglect appear to have been common in much of Europe. Historians refer to "unconscious infanticide" or "infanticide by neglect" in describing such traditional practices as sending a newborn out to a wet nurse, dosing an infant with liquor or opiates to keep it quiet, rocking babies violently in their cradles until knocked into insensibility, leaving them swaddled and unattended in their own excrement for hours on end, and having them sleep with parents and thus risk "overlaying" and suffocation. The practice of handfeeding rather than breastfeeding of infants was particularly devastating.

The nearly universal practice of abandonment or exposure of children undoubtedly contributed to high mortality rates. The city of Paris averaged some 7,000 foundlings per year in the period before the French Revolution. Data for the end of the 18th century indicate that a third of these abandoned children were legitimate and many came from bourgeois, master craftsman, and merchant families. In the Hospital of the Innocents (or foundlings) in Florence for the period 1775-94, foundlings constituted 4.2 percent of legitimate births in the two nearby villages of Fiesole and South Godenzo. In this latter case, where documentation was complete, abandonments were clearly related to the number of children in the family (table 16). The abandonment of infants declined and finally disappeared after the middle of the 19th century.

If deliberate abandonment and negligent childrearing practices and resultant high infant mortality indeed served as methods of limiting family size before voluntary means were deemed acceptable, the argument that high fertility is a result of high mortality may be the reverse order of causality. The recent evidence in Latin American that associates child neglect with increasing family size (15) may be a partial explanation of why marital fertility began its decline in Europe and has begun to decline in some LDCs today despite high rates of infant mortality.

The European decline in fertility began at different times under a wide variety of socioeconomic conditions. Table 17 shows the dates of an observed 10-percent decline in fertility and contemporary indicators of socioeconomic status. At the beginning of declines, there were large differences in rates of infant mortality, which declined slowly in many European countries during the 18th century and most of the 19th century. In the last quarter of the 19th century, both marital fertility and infant mortality declined rapidly. It may be that the ability to choose family size through family limitation was a preliminary condition to any real progress in infant and child survival.

Table 16.—Child Abandonment: Tuscany, Italy, 18th Century

(Legitimate children abandoned at the Foundling Hospital of Florence by number of children in the family: two nearby villages, 1775-94)

Number of children in family	Percent of children abandoned
1-3	24.8
4-5	37.1
6 plus	50.6

NOTE: Refers to 170 children from 133 families who abandoned at least one child and for whom there are complete records.

SOURCE: E. van de Walle and J. Knodel, "Europe's Fertility Transition: New Evidence and Lessons for Today's Developing World," *Population Bulletin*, vol. 34, No. 6, Population Reference Bureau, Inc., Washington, D.C. 1980.

Table 17.—Starting Date of Fertility Transition and Indicators of Concurrent Demographic and Socioeconomic Conditions: Selected European and Developing Countries

	Date of decline in marital fertility by 10 percent	Marital fertility before decline (I_g)	Proportion of women married (I_m)	Infant deaths per 1,000 live births	Percent of male labor force in agriculture	Percent rural[d]	Percent in cities over 20,000 population	Percent illiterate[e]
European countries								
France	ca. 1800	0.70	0.51[a]	185[c]	70	81	7	High
Belgium	1882	0.82	0.44	161	30	56	22	30
Switzerland	1885	0.72	0.44	165	33	78	9	Low
Germany	1890	0.76	0.50	221	38	68	21	Low
Hungary	ca. 1890	0.63	0.70	250	73	84	11	49[f]
England and Wales	1892	0.68	0.48	149	15	28	57	Low
Sweden	1892	0.71	0.42	102	49	81	11	Low
Scotland	1894	0.75	0.42	124	13	27	49	Low
Netherlands	1897	0.85	0.45	153[c]	29	26	42	Low
Denmark	1900	0.68	0.47	131	42	61	23	Low
Norway	1904	0.75	0.42	76	37	72	18	Low
Austria	1908	0.68	0.51	205	40	—	19	21
Finland	1910	0.70	0.46	114	66	85	9	44
Italy	1911	0.68	0.54	146	46	38	28	39
Bulgaria	1912	ca. 0.70	ca. 0.74	159	70	82	7	60
Spain	1918	0.64	0.51	158	66	45	26	46
Ireland	1929	0.71	0.35	69	48	73	20	Low
Developing countries								
Costa Rica	1962	0.89[b]	0.50[b]	74	58	66	20	14
Taiwan	1963	0.70	0.70	49	47	42	31	30
Chile	1964	0.65[b]	0.50[b]	103	37	29	53	15
Thailand	ca. 1970	ca. 0.75	0.75	77	75	85	12	18

NOTE: Country borders are of the date of decline. All figures refer to the year estimated as the date of a 10-percent decline in marital fertility except the index of the level of marital fertility before decline. Estimates were obtained by interpolation or extrapolation when data were not directly available for the year indicated.

[a] In 1831.
[b] Excluding consensual unions.
[c] Children dead after registration only.
[d] In communities of fewer than 5,000 or legal definition.
[e] Both sexes, aged 10 + or 15 +; high refers to percentages of young adults unable to sign their name on the marriage certificate or of illiterate army recruits, exceeding 50 percent; low refers to percentages under 10 percent.
[f] 6 +

SOURCE: E. van de Walle and J. Knodel, "Europe's Fertility Transition: New Evidence and Lessons for Today's Developing World," *Population Bulletin*, vol. 34, No. 6, Population Reference Bureau, Inc., Washington, D.C., 1980.

The four LDCs shown in table 17 display great diversity in rates of infant mortality and socioeconomic development. For example, Thailand was 85 percent rural but Chile less than 30 percent rural when each first recorded a fertility decline of more than 10 percent. Chile's infant mortality rate was 103 deaths per 1,000 live births in contrast to Taiwan's 49 deaths per 1,000 live births when these countries began their fertility declines. Although a number of LDCs are more industrialized and have lower illiteracy and infant mortality today than many European countries had in the 19th century, their fertility levels have not yet begun to decline.

Recent research has consistently shown the onset and spread of Europe's fertility decline to have been clustered regionally in a way that cannot be attributed to similar socioeconomic characteristics. Fertility trends were more alike among provinces in the same region, where common language, religion, or less easily documented customs are typically shared, than where cultural boundaries impeded the flow of information and the process of diffusion. Thus, the diffusion of knowledge of the ability to limit fertility as facilitated by cultural homogeneity played a major role.

There are differences between LDCs today and European countries prior to their fertility decline that have important implications for the demographic transition in LDCs. There are also valuable lessons to be learned from the similarities between these groups. Population growth rates in Western Europe were far lower than the extremely rapid rates of many LDCs in recent decades. There are two principal reasons for this. First, although marital fertility during the predecline period in Europe was high, if not higher, than in these LDCs, overall birth rates were substantially lower in Europe due to late age at marriage and large proportions who remained permanently single. Second, because death rates declined more slowly than they have recently in LDCs, they were generally higher in Europe at equivalent stages of the demographic transition. In addition, because of rapidly declining mortality, sustained high fertility that has only recently begun to decline, and larger initial populations, LDCs today are experiencing unprecedented increases in absolute numbers. For example, in Sweden in 1855—about 40 years before its fertility decline began—the birth rate was 33 per 1,000 population and the death rate 22 per 1,000, which translates to an annual growth rate of 1.1 percent and a population doubling time of 63 years. By contrast, in Taiwan in 1953, 10 years before its fertility decline began, the birth rate was 45 per 1,000 and the death rate 9 per 1,000, producing an annual growth rate of 3.6 percent and a doubling time of 19 years. The unique marriage pattern in predecline Europe coupled with slower declines in mortality rates kept birth rates and annual growth rates lower.

Other features make the two transitions similar and provide valuable lessons for LDCs today. These include the diversity of social, economic, and demographic conditions under which Europe's fertility transition took hold; the remarkable concentration of the starting dates; the absence of deliberate birth control within marriage before the decline despite evidence that a substantial proportion of births were unwanted; the apparent coincidence of the decline with the sudden adoption of family limitation practices; the rapid spread of such practices, once they appeared; the resulting drastic change in reproductive behavior; the irreversibility of the process once under way; and the importance of cultural factors among those that appeared to influence the onset and spread of the fertility decline. These same features can be identified in many LDCs today.

There was only a loose relationship in Europe between the level of socioeconomic development and fertility decline. Although a relatively high level of development may often accompany a decline in fertility, it is clearly not a precondition. There appears to have been an important innovation-diffusion dimension to the reproductive revolution that swept Europe. Thus, the "legitimating" function of a government or privately sponsored program may be of considerable importance. The inexorable spread of family limitation in the past sharply contradicts the assumption sometimes made that family planning programs in today's LDCs can reach only a limited number of users and that, after initial success, demand for contraceptives services will lessen. Because it has traditionally been and continues to be the wife who wants to limit her fertility, and today's methods are primarily used by women, use of modern contraceptive methods should accelerate rapidly once introduced. Whether or not a family planning program meets with success will be determined by how receptive couples are to the idea of reducing their fertility once the knowledge and means to do so are available. The absence of family planning efforts prior to campaigns to disseminate information and services does not necessarily indicate a lack of such receptivity. It may instead reflect an unfamiliarity with the concept and methods of family limitation.

Knowledge of the factors that determined receptivity during the early stages of the transition is quite incomplete, and the level of development necessary to provoke a change in reproductive behavior is so variable that no prediction can be made. The historical record provides no affirmation that efforts to reduce fertility or hasten fertility decline through raising the level of socioeconomic development will meet with early success. It is reasonable to assume, however, that efforts designed to influence fertility will fail unless attention is paid to the long-established cultural values that govern fertility behavior in specific societies.

Until these cultural barriers are modified, neither higher levels of socioeconomic development nor family planning programs are likely to hasten fertility decline. Although the historical record does not identify those cultural factors most likely to influence the acceptance of family limitation, it does suggest that factors that determine the status of women and their ability to assert their own wishes regarding childbearing are extremely important. Where the concept of family planning becomes legitimate and the knowledge and means to plan fertility become available, a climate of receptivity is created that is likely to be rapidly diffused.

Technical Note B: The measurement of contraceptive prevalence[2]

Estimating the prevalence of contraceptive use in a population, which is a measure of the proportion of a population practicing contraception at a particular point in time, is analogous to taking a snapshot of the reproductive behavior of that population. The prevalence rate is the percentage of all women of reproductive age (15 or 20 to 44 or 49) currently living in some type of stable union ("married") who are currently using contraception. For example, 23 percent of such women in India are currently using some form of contraception while only 5 percent of their counterparts in Pakistan are doing so. These figures are snapshot views for 1979 and 1975, respectively (table 15).

Although prevalence rates appear straightforward, reliable prevalence rates are difficult to obtain for several reasons. If there is extensive use of contraception outside of marriage, this use will not be measured since rates are calculated on the basis of women currently in some type of stable union. Unless the survey is truly representative of the population and the quality of research, questionnaire design, and fieldwork are adequately controlled, the data will be questionable. Even with good quality control, contraceptive use can be underreported because respondents may be shy, may wish to hide the truth, or may misunderstand the questions.

Prevalence rates can vary depending on the contraceptive methods included in the index of current contraceptive use. Traditional methods such as herbs, withdrawal, or abstinence can augment the percent of women who report using contraception. Traditional methods, however, are not usually reliable and such women are in effect at risk of unwanted pregnancy. Menstrual regulation and induced abortion as post coital methods are usually excluded from calculations of the percentages of women using contraception, but their use may represent a significant proportion of the effective contraceptive protection in a population. Thus, the prevalence rate may be lower than expected when compared with the birth rate because women are relying on postcoital methods in cases of contraceptive failure. For example, because pills or IUDs may not be as available as spermicides or condoms in some countries, menstrual regulation and/or induced abortion are used in the event of method failure.

It is necessary to distinguish between sterilization for contraceptive purposes and sterilization for health reasons. The basis for the sterilization procedure is ascertained from women survey respondents. It is often difficult for a woman to distinguish the *primary* cause for sterilization when she has as many children as she wants, her doctor has advised her that having more would probably threaten her health and well-being, and when the couple's income is inadequate for the support of another child.

Thus, there is always a margin for error in the determination of contraceptive prevalence rates. In surveys such as the World Fertility Survey and the contraceptive prevalence surveys currently being undertaken by Westinghouse and the Center for Disease Control,[2] this "sampling" error is being calculated and prevalence rates are shown with calculations of probable ranges of error (e.g., a rate of 50 percent plus or minus several percentage points). These sampling ranges have not been included in this document, but may be obtained from the sources cited in the text tables of contraceptive prevalence.

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[2] For details on contraceptive prevalence surveys see Sir Maurice Kendall, "The World Fertility Survey: Current Status and Findings," *Population Reports*, Series M, No. 3, Population Information Program, The Johns Hopkins University, July 1979, and L. Morris, et al., "Contraceptive Prevalence Surveys: A New Source of Family Planning Data," *Population Reports*, Series M, No. 5, May-June 1981, Population Information Program, The Johns Hopkins University, Baltimore, Md.

Technical Note C: Age at marriage[3]

Women who marry early tend to have more children than those who marry later for three demographic reasons:

- they are likely to have sexual intercourse frequently throughout their most fecund years (later-marrying women will have sexual intercourse during fewer of their fecund years);
- they begin childbearing at an early age, live through a longer period of exposure to the possibility of pregnancy, and thus, in the absence of

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[3] For further details see A. Henry and P. Piotrow, "Age at Marriage and Fertility," *Population Reports*, Series M, No. 4, November 1979, Population Information Program, The Johns Hopkins University, Baltimore, Md.

contraception, are apt to have more children than women who marry later; and

- by their early childbearing, they shorten the interval before the next generation is born.

Figure 17, which illustrates the effect of age at marriage (in the absence of contraceptive use), assumes that a woman gives birth to a daughter every 5 years until she reaches age 40. If her age at marriage is 15, she gives birth to a daugher at age 20 (at left of figure). By the time this woman reaches age 40, she has had 5 daughters and the eldest has given birth to *her* first daughter. After a period of 60 years, if age at marriage is 15, the resulting female population would total 22. Using the same assumptions, but changing age at marriage to 20 (as shown in the central portion of the figure), the total female population would rise to only 11 after 60 years. If age at marriage is raised to age 25 (as shown at the right of the figure), the female population would consist of only 5 members after the same time period.

Figure 17.—Effect of Age at Marriage

Age at marriage is 15 years

Age	
0	A is born
10	
15	A marries
20	B1 is born
25	B2 is born
30	B3 is born
35	B4 is born
40	$(C1)_1$ B5 is born
45	$(C1)_2(C2)_1$
50	$(C1)_3(C2)_2(C3)_1$
55	$(C1)_4(C2)_3(C3)_2(C4)_1$
60	$(C1)_5(C2)_4(C3)_3(C4)_2(C5)_1$
	$(D1)_1$

Female population after 60 years: 22

Age at marriage is 20 years

Age	
0	A is born
5	
10	
15	
20	A marries
25	B1 is born
30	B2 is born
35	B3 is born
40	B4 is born
45	
50	$(C1)_1$
55	$(C1)_2(C2)_1$
60	$(C1)_3(C2)_2(C3)_1$

Female population after 60 years: 11

Age at marriage is 25 years

Age	
0	A is born
5	
10	
15	
20	
25	A marries
30	B1 is born
35	B2 is born
40	B3 is born
45	
50	
55	
60	$(C1)_1$

Female population after 60 years: 5

SOURCE: After A. Henry and P.T. Piotrow, "Age at Marriage and Fertility," *Population Reports*, Series M, No. 4, 1979 Population Information Program. The Johns Hopkins University, Baltimore, Md.

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Chapter 5

The Technology of Fertility Change: Present Methods and Future Prospects

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Chapter 5

The Technology of Fertility Change: Present Methods and Future Prospects

Abstract

Of the technologies that change birth rates, contraceptive technologies are the most important. Current contraceptive methods, in the order of their use effectiveness, are sterilization, the various forms of steroid hormones, IUDs, barrier devices, vaginal spermicides, coitus interruptus, periodic abstinence (rhythm, natural family planning), and postcoital douches. Contraceptives are judged by the degree to which they are effective; safe; reversible; easy to produce, provide, and use; inexpensive; and acceptable to governments, cultures, religions, and individuals. The "ideal" contraceptive neither exists nor is expected to be developed. A realistic goal is for each country to have enough technologies that are appropriate for local conditions and standards so that each individual has access to at least one that meets current needs. Method risks of contraceptive use are largely confined to oral contraceptives and IUDs. Circulatory system diseases associated with oral contraceptives have caused the most concern and could theoretically cause a fivefold increase in deaths. But nearly three-quarters of the cardiovascular disease deaths occurring annually in the United States to women of reproductive age would be attributable to oral contraceptive use if the increased risk were indeed fivefold. This has not been reflected in vital statistics trends. In extending comparisons of relative risks to women in less developed countries (LDCs), all methods are found safer than no method at all because of high maternal mortality rates in these countries.

New or improved technologies likely to be available by 1990 include safer oral contraceptives, improved IUDs, improved barrier contraceptives for women, improved long-acting steroid injections, improved ovulation-detection methods for use with periodic abstinence, steroid implants, steroid vaginal rings, LRF-analog contraceptives for women, and prostaglandin analogs for induction of menses. Methods that could emerge by 1990 include a monthly steroid-based contraceptive pill, improved monthly steroid injections, new types of drug-releasing IUDs, minidose vaginal rings, an antipregnancy vaccine for women, improved barrier contraceptives for men, sperm suppression contraceptives for men, reversible female sterilization, simplified male and female sterilization, and LRF-analogs for self-administered induction of menses. Methods that could be available by 2000 include an antifertility vaccine for men, antisperm drugs for men, lactation-linked oral contraceptives for women, ovulation prediction techniques for use with periodic abstinence, new types of antiovulation contraceptive drugs for women, drugs for women that disrupt ovum transport, reversible male sterilization, pharmacologic or immunological sterilization for men and women, and agents other than LRF analogs for self-administered induction of menses. Limitations of contraceptive technologies and lack of access to their use cause women in all parts of the world to seek induced abortions to terminate unwanted pregnancies; their large numbers are an index of contraceptive need rather than preference for abortion. Technological innovations that could have a major impact on capacity to diagnose the causes of infertility include development of simple techniques to predict and confirm ovulation, tests to determine level of functioning of male seminiferous tubules, and further development of ovulation-inducing drugs. LRF-agonists for inducing ovulation and LRF-agonists and other possible releasing-factor analogs for increasing sperm production are likely to be useful in inducing fertility. Although sex preference is strong in LDCs, present technologies for sex selection are highly ineffective and there is little likelihood of a product for general use becoming available by 2000. All current fertility planning methods have one or more serious shortcomings. Although existing methods have considerable unused potential for lowering LDC birth rates in the next two decades, the need for most couples to use contraception for up to 25 years points to the disparity between existing technologies and both current and future requirements for contraceptive use.

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Introduction

Technologies modify each of the three components—birth, death, and migration—of population growth. Medical, agricultural, and sanitation technologies are essential to the reduction of death rates. Communication and transportation technologies play key roles in all aspects of population change. This report, as stated earlier, focuses on the technologies that help to change birth rates, and this chapter deals with the specific fertility planning technologies that human beings use to affect the numbers and characteristics of births.

The most common and most important of these technologies are those used to prevent unwanted pregnancy: contraceptive technologies. Less common but important at present are those used for early termination of unwanted pregnancy. Still less common but very important in some societies are technologies used to prevent or correct unwanted infertility. Uncommon and little developed are the sex selection technologies used to determine an infant's sex at conception. Techniques to detect pregnancy or important abnormalities of pregnancy or to preselect genetic characteristics are not included in this study.

The human reproductive process

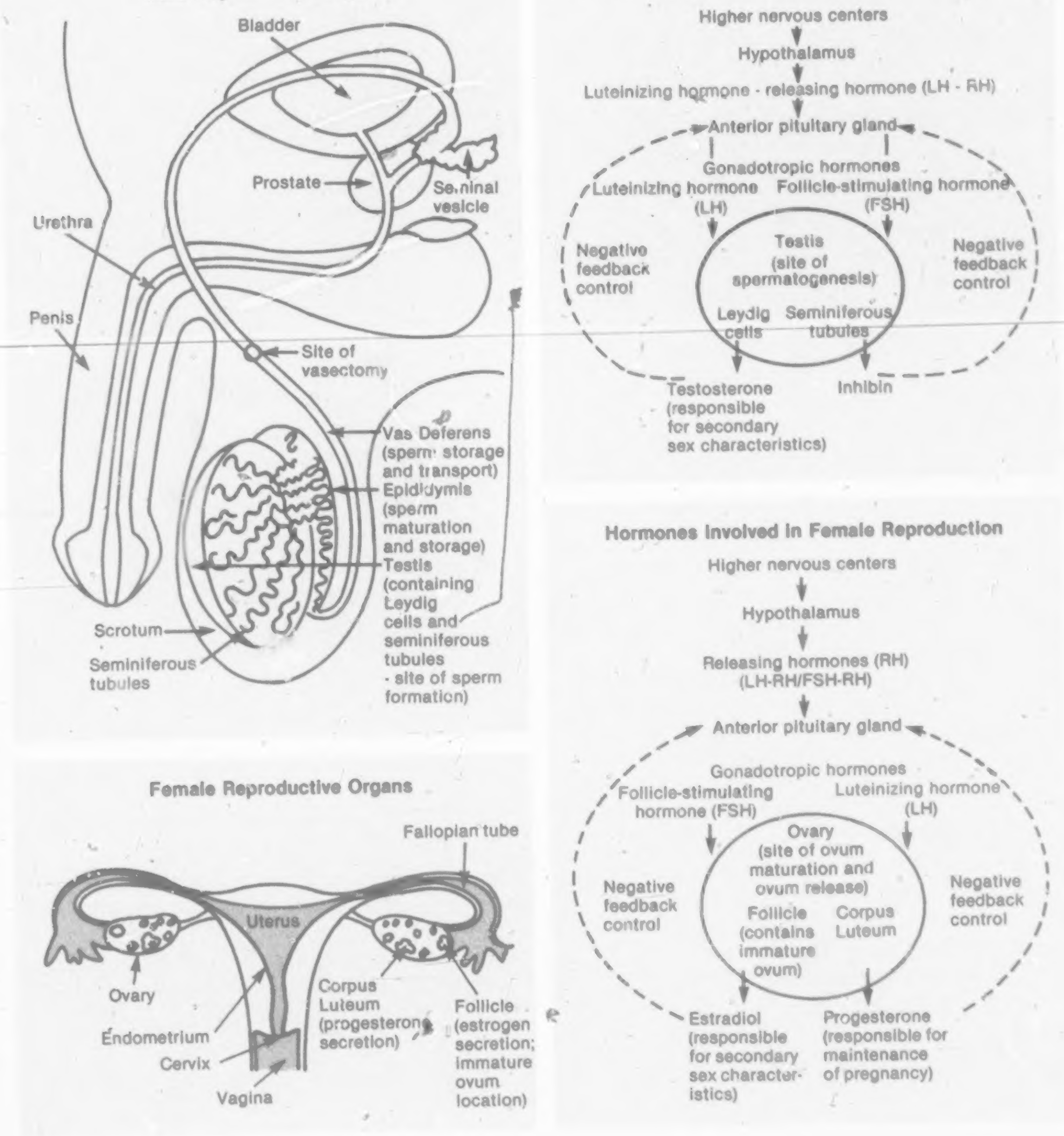
Sperm are produced continuously in the testes from puberty throughout most of the male's life. The process begins with division of germ cells (spermatogonia) which, in combination with supporting (Sertoli) cells, make up the long seminiferous tubules that take up most of the testes. Interspersed Leydig cells produce male hormones (androgens), notably testosterone, which affect both sperm production and male sex characteristics. Sperm production takes about 72 days. The final stages of sperm maturation take place in the small ducts and long epididymis at the back of the testes. The sperm are ejaculated by a muscular tube, the vas deferens, which enters the urethra as it traverses the prostate gland.

The female menstrual cycle is approximately 28 days, normally ending with menstrual flow unless pregnancy occurs. The germ cells are in the two ovaries and number several million in the fetal stage, are fewer than 1 million at birth, and gradually decrease throughout life. One matures each month in a follicle on the ovary's surface that also produces the hormone, estrogen. The follicle ruptures, and the ovum travels down the fallopian tube to the uterus. The ruptured follicle then changes to a yellowish protrusion on the ovary called the corpus luteum, which begins to produce another hormone, progesterone, in addition to continued estrogen production. The corpus luteum regresses if pregnancy does not occur. These hormonal changes also prepare the uterus for a possible pregnancy, but if pregnancy does not occur, the uterine lining is sloughed off, producing the menstrual flow.

In both male and female, sex hormone production is regulated by gonadotropins—hormones from the pituitary gland located just below the brain. The gonadotropins are controlled in turn by the luteinizing hormone releasing factor (LRF) from the hypothalamus, an adjacent section of the brain. In the female, the gonadotropins include the follicle stimulating hormone (FSH), which stimulates follicle growth, and luteinizing hormone (LH), which stimulates estrogen production by the follicle, promotes rupture of the follicle, and, after rupture of the follicle, also stimulates progesterone production from the resulting corpus luteum. Estrogen and progesterone levels act as feedback mechanisms on the hormones released from the hypothalamus and anterior pituitary. The central nervous system also can influence the menstrual cycle. In the male, FSH acts on the

Sertoli cells and is necessary for the initiation of spermatogenesis. LH regulates the secretion of testosterone by the Leydig cells. Testosterone and other male hormones act as the feedback mechanisms. Figure 18 summarizes the human reproductive cycle.

Figure 18.—Human Reproductive Cycle


Male Reproductive Organs
Bladder
Prostate
Seminal vesicle
Urethra
Penis
Site of vasectomy
Vas Deferens (sperm storage and transport)
Epididymis (sperm maturation and storage)
Testis (containing Leydig cells and seminiferous tubules - site of sperm formation)
Scrotum
Seminiferous tubules
Hormones Involved in Male Reproduction
Higher nervous centers
Hypothalamus
Luteinizing hormone - releasing hormone (LH - RH)
Anterior pituitary gland
Gonadotropic hormones
Luteinizing hormone (LH)
Follicle-stimulating hormone (FSH)
Testis (site of spermatogenesis)
Leydig cells
Seminiferous tubules
Negative feedback control
Negative feedback control
Testosterone (responsible for secondary sex characteristics)
Inhibin
Female Reproductive Organs
Fallopian tube
Uterus
Ovary
Endometrium
Cervix
Vagina
Corpus Luteum (progesterone secretion)
Follicle (estrogen secretion; immature ovum location)
Hormones Involved in Female Reproduction
Higher nervous centers
Hypothalamus
Releasing hormones (RH) (LH-RH/FSH-RH)
Anterior pituitary gland
Gonadotropic hormones
Follicle-stimulating hormone (FSH)
Luteinizing hormone (LH)
Ovary (site of ovum maturation and ovum release)
Follicle (contains immature ovum)
Corpus Luteum
Negative feedback control
Negative feedback control
Estradiol (responsible for secondary sex characteristics)
Progesterone (responsible for maintenance of pregnancy)

SOURCE: C. Djerassi, *The Politics of Contraception*, Norton, 1980.

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Human reproduction, as for other mammals, is characterized by relatively long intervals of natural infertility in the female. Fertilization can only take place within a few days after ovulation. Pregnancy occurs following fertilization of the ovum by the sperm, usually in the fallopian tube, and implantation of the embryo in the uterus. When pregnancy occurs, the corpus luteum is maintained by another hormone, human chorionic gonadotropin (HCG), secreted by the implanted embryo, and estrogen and progesterone continue to be produced. Once delivery has taken place, further ovulation is temporarily blocked by the hormonal changes induced by the infant's suckling, including a rise in the level of another pituitary hormone, prolactin.

Contraception

Methods

The major methods of contraception currently in use, listed in order of their use effectiveness in preventing pregnancy, are:

- Sterilization—vasectomy in the male, and tubal ligation/occlusion in the female.
- Steroid hormones—combined (estrogen and progestin) or low-dose progestin oral pills, or intramuscular, long-acting progestin injections. These synthetic steroids are given in different combinations and different doses, depending on the commercial product, but they act primarily by inhibiting ovulation through suppression of the hypothalamic hormones that stimulate the release of FSH and LH from the anterior pituitary. The synthetic steroids also cause endometrial changes that make the uterus inappropriate for implantation should breakthrough ovulation and fertilization occur. Other changes that contribute to the contraceptive effect include scant and thick cervical mucus, reduced sperm transport and penetration into the uterus, and altered sperm and ovum transport capabilities within the fallopian tubes.
- Intrauterine devices (IUDs)—the insertion of a foreign body, made either of an inert substance or impregnated with other materials (copper, progesterone). Although the IUD prevents implantation in mammals, its mode of action is unknown in the human being. There are several possible modes of action, from interference with sperm transport, to interference with ovum transport, to interference with implantation in the uterus. There is also some evidence that IUDs lead to increased sperm damage and affect the motility of the ovum in the fallopian tube.
- Barrier devices—the condom for the male and the diaphragm and cervical cap for the female.
- Vaginal spermicides—high viscosity fluids that both kill sperm and block them from entering the cervical canal.
- Coitus interruptus—male withdrawal prior to ejaculation.
- Periodic abstinence (rhythm, natural family planning)—timed to avoid coitus near the day of ovulation.*
- Postcoital douches—water or spermicidal solutions that flush out and kill sperm in the vagina.

---

*The basal body temperature (BBT) method of periodic coital abstinence uses daily temperature-taking to identify the temperature shift that occurs at or shortly after ovulation to determine the "safe" days of the menstrual cycle. By the evening of the third day of sustained high temperature readings following the shift, which may be abrupt or gradual, the postovulatory infertile phase is assumed to be under way. Intercourse must be limited to this phase for highest effectiveness. Cycles during which ovulation does not occur and there is no temperature shift can be a problem during postpartum and premenopausal periods. In the Ovulation—or Billings—method, a woman is taught to identify the precise characteristics of the cervical mucus produced at various stages of her menstrual cycle and their relationship to her fertile and infertile days. In the Sympto-Thermal method, which charts both temperature changes and changes in volume and viscosity of cervical mucus, women are also taught to recognize such subjective symptoms of ovulation as intermenstrual pain.

Characteristics

The potentials of present contraceptive technologies and the limitations that future technologies will need to overcome depend upon how well their characteristics meet the requirements of such diverse groups as users, providers, program administrators, physicians, scientists, theologians, and politicians in various countries and cultures.

Contraceptive technologies are judged by the degree to which they are:

- effective—prevent pregnancy;
- safe—are free of deleterious side effects;
- reversible—permit subsequent pregnancies upon discontinuation of use;
- easy to produce—do not require complex industrial processes;
- easy to provide—do not require frequent resupply or specialized personnel;
- easy to use—do not require periodic application or interfere with coitus;
- inexpensive—have low economic costs to user or society;
- acceptable to governments—are permitted or encouraged by laws and regulations;
- acceptable to cultures—are consonant with local beliefs and customs;
- acceptable to religions—are consonant with religious beliefs; and
- acceptable to individuals—promote general well-being, enhance sexual enjoyment, fit lifecycle, and protect privacy.

How well any characteristic of a contraceptive technology meets individual and societal requirements depends not only on the technology, but on the views and actions of the society in which it is used and of the individuals who use it.

The myth of the ultimate, "ideal" contraceptive is precisely that. The perfect contraceptive would be completely effective in preventing pregnancy, have no harmful effects, be fully reversible, simple and inexpensive to produce and use, need no supplies, specialized personnel, or repetitive use, be acceptable to all governments, cultures, and religions, and fit the needs of all potential users at all stages of their reproductive lives. No such method exists or is expected to be developed. *A realistic goal is for each country to have enough technologies that are appropriate for local conditions and standards so that each individual has access to at least one that meets current needs.*

Effectiveness

Contraceptive failure rates are usually quantified according to theoretical v. use effectiveness, because contraceptive failure under average conditions of use can be significantly higher than when methods are used correctly and consistently. The effectiveness of the contraceptive methods listed above is summarized in table 18, where they are listed in descending order of effectiveness under ideal and actual conditions of use. The failure rates represent the number of pregnancies among 100 nonsterile women using the method for 1 year in the United States. If they were to use no contraceptive method, about 90 percent of these women would become pregnant within a year.

Sterilization is the most effective contraceptive method. Use effectiveness equals theoret-

Table 18.—Theoretical and Use Effectiveness of Various Means of Contraception
(by pregnancies per 100 woman-years in MDCs)

Method	Theoretical effectiveness	Use effectiveness Range	Use effectiveness Average
Sterilization:			
Tubal	—	—	0.06
Vasectomy	—	—	0.15
Steroidal contraceptives:			
Injectable progestins (3-month regimen of medroxyprogesterone acetate)	0.24	—	0.24
Orals	0.1	0.2-4.5	0.7
IUDs:			
Lippes loop	1.9	—	2.7
Copper T	—	—	2.2
Diaphragm and jelly	3	3.3-33.6	12
Condom	3	6-30	12
Aerosol foam	3	3.0-35	14
Jelly or cream	4	2.0-45	20
Coitus interruptus	8	10-38	18
Periodic abstinence	2.5	5-40	20
Suppositories	14	17-27	22
Douche	18	21-40.8	35

SOURCES: R. G. Wheeler, G. W. Duncan, and J. Speidel, *Intrauterine Devices—Development, Evaluation, and Program Implementation*, Academic Press, 1974; and L. Liskin, "Periodic Abstinence: How Well Do New Approaches Work?" Population Information Program, The John Hopkins University, Baltimore, Md., September 1981.

ical effectiveness because the procedure is usually performed adequately in the United States and there is no need for additional contraceptive practice once the surgical procedure is performed. The obvious drawback of sterilization is its permanence. For female sterilization, although individual surgeons have reported reversal rates as high as 60 percent, it is estimated that only about one-fifth of all women sterilized by current techniques could have their sterilizations reversed (8). For reversal of male sterilization, the rate of anatomical success as determined by the reappearance of sperm is in the range of 40 to 90 percent, but functional success as determined by the pregnancy rate is much lower, on the order of 18 to 60 percent (3); new microsurgery techniques are reported to have increased the upper range to 70 percent (21).

The steroid hormones and IUDs are very effective in preventing pregnancy, but the degree of prevention depends on how correctly and consistently they are used. Barrier devices (condoms, diaphragms) approach the IUD in theoretical effectiveness but have three to four times the failure rate of the IUD in use effectiveness. The use of vaginal spermicides, coitus interruptus, and periodic abstinence also significantly lower pregnancy rates, but about 20 percent of users will still become pregnant within a year. Postcoital douching also has a preventive effect but will protect only about 35 percent of users.

New techniques are now being employed to evaluate pregnancies that occur during use of periodic abstinence methods. Unintended pregnancies are analyzed in terms of when in the woman's cycle they occurred and whether the couple proceeded with a particular act of intercourse despite advance knowledge of the reasonable likelihood of conception; which of these pregnancies can be attributed to the methods themselves; and which pregnancies are likely to have resulted from difficulties in teaching or learning the various methods (10).

Most determinants of effectiveness are inherent in the technology, but variations occur depending on the conditions and behavior of the user. The closer a couple are to the number of children they want, the more effective is their use of barrier methods or periodic abstinence. Couples who are using contraception to prevent any future births achieve much higher effectiveness than couples merely spacing the next birth. Highly motivated and experienced couples can prevent pregnancy much more effectively than less motivated couples.

Risks

Risk estimates attempt to compare the relative risks of each contraceptive method not only against other methods but also against the risk of using no contraceptive method. The latter risk is in becoming pregnant and the morbidity and mortality associated with pregnancy and childbirth. The risks of each contraceptive method are the morbidity and mortality associated with use of the method and with those pregnancies that the particular method does not prevent. For these comparative estimates, the measure of risk used is the death rate, comprised of method-associated (use of a particular contraceptive method or failure of a contraceptive method) and birth-associated (use of no contraceptive method) deaths.

A further distinction must be made between absolute and relative risks. For example, relative incidence in the population is important.

> If the incidence of a disease is 1 per million among non-exposed persons, and the use of a particular drug increases the relative risk of disease tenfold, then one would anticipate 10 cases per million users of the drug. On the other hand, if the incidence of another disease is 100 per million, and drug exposure increases the risk only twofold, then one would anticipate 200 cases per million among users of the drug. The latter situation would clearly entail a much greater public health problem, even though the relative risk is much smaller (24).

Language is also important when studies of risk are discussed. For example, the conclusion that oral contraceptive users have a five times greater risk of dying from circulatory disease than nonusers can be rephrased to point out that pill users decrease their chances of survival during a year from 99,995 per 100,000 to 99,974 per 100,000—a reduction of only two-hundredths of a percent (0.02 percent) (12).

The method-related risks of contraceptive use are largely confined to oral contraceptives and IUDs. Some morbidity and mortality are also associated with sterilization procedures, but these are limited to the time at which the procedure is performed. Barrier devices and spermicides are relatively risk-free except for the risks associated with pregnancy from the higher degree of contraceptive failure with these methods.

Barrier devices, principally those used by the woman, have been associated only with minor side effects—allergic reactions, vaginal irritation, and infections (26).

Spermicides, apart from local reactions such as tissue irritation to either partner, have been considered very safe insofar as method-related risks are concerned. Such risks might be incurred from: 1) systemic effects on the woman resulting from absorption of the spermicide through the vagina; 2) damage to a developing fetus from spermicide components or metabolites in the woman's circulation; and 3) genetic damage to conceptions involving sperm damaged by spermicides (5). A recent study has shown a positive correlation between spermicide use in the 10 months prior to conception and the prevalence of certain major congenital anomalies (9). The prevalence of such abnormalities as limb-reduction deformities, neoplasms, and syndromes associated with chromosomal abnormalities was 2.2 percent, compared to an incidence of 1 percent in infants born to mothers who had not used spermicides in the 10 months prior to conception. The rate of spontaneous abortion requiring hospitalization was also 1.8 times more common. The investigators considered these findings tentative, as these abnormalities were diverse and did not appear as a well-defined syndrome. This area clearly warrants further investigation.

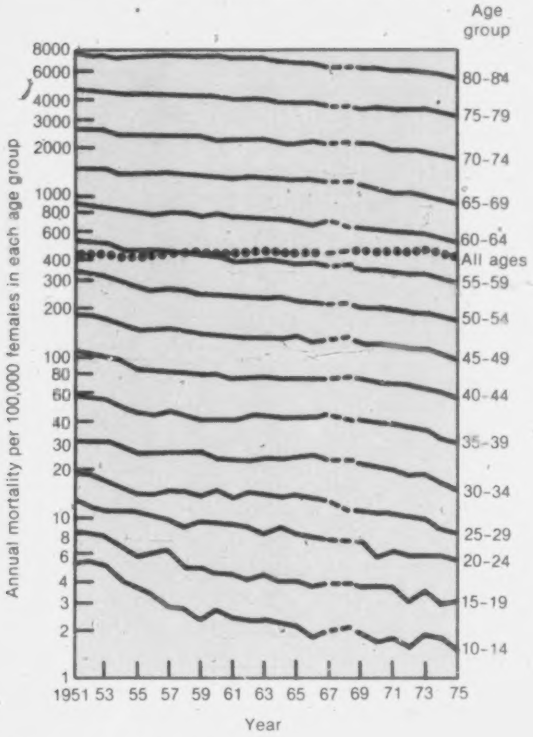
The basic risks of IUDs are: 1) increased menstrual bleeding or spotting; 2) perforation of the uterus; 3) increased frequency of pelvic infection; and 4) unwanted pregnancies that are more likely to be ectopic (implanted outside the uterus in the fallopian tube or abdominal cavity) or to result in septic midtrimester abortion than pregnancies in nonusers (17). Method-related mortality from IUDs stems principally from ectopic pregnancies—a life-threatening emergency—and septic abortions.

Circulatory system diseases associated with oral contraceptives have caused the most concern. Venous thromboembolic disease—principally of the legs—was the first recognized circulatory system risk associated with oral contraceptive use. Excess mortality has been estimated at 2 to 3 per 100,000 women annually, with no increase of risk associated with duration of use. Heart attacks and subarachnoid hemorrhage—a type of stroke probably from rupture of congenitally weak cerebral blood vessels—are the other circulatory system risks. The risk of heart attack depends on other predisposing factors, e.g., cigarette smoking, hypertension, diabetes. The chances of heart attack thus increase with age, smoking, and other predisposing factors. The risk of subarachnoid hemorrhage increases with smoking and duration of use (17).

Together, these circulatory system diseases would theoretically account for a fivefold increase in deaths, but questions have arisen as to why such an increase has not been reflected in vital statistics trends. A researcher at the U.S. Center for Disease Control estimates that nearly three-quarters of the cardiovascular disease deaths occurring annually in the United States to women of reproductive age would be attributable to oral contraceptive use if the increased risk was indeed fivefold. Such a high proportion of cardiovascular deaths attributable to oral contraceptive use should have been reflected in dramatically increased rates of cardiovascular deaths in women of reproductive age since the onset of oral contraceptive use, but such increased rates have not appeared. In addition, instead of the death rate from these diseases diverging for men and women as would be expected, U.S. cardiovascular disease death rates have been falling nearly equally and steadily for men and women of reproductive ages since 1950 (13). (See fig. 19 for circulatory system death rates for U.S. women.)

Research on long-term risks of oral contraceptives has found no statistically significant increase in the cancer rate. A rare type of benign liver tumor does occur, especially with the older

Figure 19.—Mortality From All Circulatory System Diseases,[a] Females, Aged 10-84, by 5-Year Age Groups, United States, 1951-75



[a]ICD 390-458 (1968-75); ICD 330-334 (1951-67

SOURCE: R. T. Ravenholt and Ward Rinehart, "Age Specific Mortality Trends in the United States Relative to Use of Oral Contraceptives," from *Risks, Benefits and Controversies in Fertility Control*, Sciarra, Zatuchni, and Speidel (eds.), PARFR series on fertility regulation, 1978, Harper & Row.

high-dose oral contraceptives, and the risk increases with duration of use, but the disease is still rare (1). Oral contraceptives appear to have a protective effect against benign breast tumors, and there have been recent indications that they may also have a protective effect against ovarian cancer, perhaps from the interruption of ovulation (17).

Using what is known about the effectiveness and risks of the different contraceptive methods, researchers have developed models that compare their relative risks. This comparison for MDCs is summarized in table 19. Sterilization is not included but the use of induced abortion (which is here assumed to be legal and performed in medically approved settings), either alone or in conjunction with barrier methods, is included.

In MDCs, between ages 25 to 35, the risk for oral contraceptive users who smoke is about the same as for those using no method, but is 50 percent higher between ages 35 to 39 and about three times higher after age 40. For nonsmoking oral contraceptive users, the risk is much less under age 40. Barrier methods in combination with access to legal abortion in the event of contraceptive failure are the safest, but induced abortion is a controversial method which is morally unacceptable to many, or, if acceptable, may not be readily available. IUDs have low risk rates throughout the reproductive years.

This model has been extended to the LDCs and is summarized in table 20. The principal assumptions are: 1) the ability to become pregnant is the same in more developed countries (MDCs) and LDCs but lactational amenorrhea following childbirth is 8 months longer in LDCs because of the higher prevalence of breastfeeding; 2) maternal mortality in Korea and Taiwan is representative of rates for middle-income LDCs and maternal mortality in Bangladesh is representative of rates in poorer LDCs; 3) maternal mortality due to induced abortion is twice as high in middle-income LDCs and five times as high in low-income LDCs as in the United States; 4) use-effectiveness of all methods except IUDs is slightly lower in LDCs; 5) method-related risks from IUDs and sterilization are two to five times higher in LDCs; and 6) risks of circulatory disease are lower in all LDCs. Oral contraceptive users are separated into those with and without predisposing conditions, and sterilization in women—tubectomy—is also included.

Because of the higher maternal mortality rates in LDCs, all methods are safer than no method at all except for some methods for older women. In middle-income LDCs, oral contraceptive users with predisposing conditions and over age 40 have a higher risk of death than those who use no method, but in poorer countries, oral contraceptive use is safer. As in the MDCs, barrier methods in combination with access to

Table 19.—U.S. Birth-Related, Method-Related, and Total Deaths per 100,000 Women per Year, by Contraceptive Method and Age of Woman, 1972-78

	Age in years					
Regimen	15-19	20-24	25-29	30-34	35-39	40-44
No control:						
Birth-related	4.7	5.3	6.5	10.7	19.3	23.2
Oral contraceptives only/nonsmokers:						
Birth-related	0.1	0.2	0.2	0.3	0.6	0.5
Method-related	0.6	1.1	1.6	3.0	9.1	17.7
Total deaths	0.7	1.3	1.8	3.3	9.7	18.2
Oral contraceptives only/smokers:						
Birth-related	0.1	0.2	0.2	0.3	0.6	0.5
Method-related	2.1	4.2	6.1	11.8	31.3	60.9
Total deaths	2.2	4.4	6.3	12.1	31.9	61.4
IUDs only:						
Birth-related	0.1	0.2	0.2	0.3	0.6	0.5
Method-related	0.8	0.8	1.0	1.0	1.4	1.4
Total deaths	0.9	1.0	1.2	1.3	2.0	1.9
Barrier methods only:						
Birth-related	1.1	1.5	1.9	3.3	5.0	4.0
Abortion only:						
Method related	0.5	1.1	1.3	2.0	1.9	1.2
Barrier methods plus abortion:						
Method-related	0.1	0.2	0.2	0.3	0.3	0.2

SOURCE: C. Tietze, *Induced Abortion—A World Review, 1981*, Population Council Fact Book, 4th ed.

legal abortion provided under adequate medical supervision in the event of contraceptive failure are the safest, but the higher maternal mortality rates make all methods—with the exceptions noted above—safer than no method at all. Thus, in LDCs, the risks of the different methods are relatively less significant than in MDCs because of much higher maternal mortality rates, and the choice of methods depends more on different legal and medical circumstances, kinds of methods available, and the convenience and acceptability of particular methods.

Future technologies

The following forecasts are based on four major elements. The first is the past rate of innovation in reproductive and contraceptive research. Between 1960 and 1970 a revolution in contraceptive technology occurred, and more than a dozen new technologies—oral contraceptives, IUDs, and new sterilization and abortion techniques—reached the public. This rapid pace of innovation continued through the 1970's, which saw the widespread introduction and adoption of new types of vaginal spermicides, contraceptive injections, drug-releasing IUDs, outpatient sterilization methods, and low-dose oral contraceptives.

A second element is the present base of knowledge available to researchers. As early as 1974, it was evident that the field of reproductive biology was benefiting from the explosion of basic research in biology and especially from fundamental new discoveries in biochemistry and genetics made during the 1960's (2). The consolidation of knowledge about these new discoveries that took place during the 1970's has been extensively applied in the areas of scientific methodology, medicine, and fertility.

A third element is the magnitude of current applied research and development efforts. A worldwide network of facilities is engaged in the development of fertility planning agents with government and private foundation support. Private companies are also working to develop new methods.

The fourth basis for these forecasts is expert opinion on both the overall likelihood of innovation in this field, and on the likelihood of devel-

Table 20.—Annual Number of Birth-Related and Method-Related Deaths per 100,000 Nonsterile Women, by Fertility Planning Method, Age, and Development of Country

	Age group/country type								
	15-19			20-24			25-29		
Regimen	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II
No method:									
Birth-related	5.6	8.3	290.0	6.1	9.2	183.8	7.4	10.8	215.9
Oral contraceptives (no predisposing conditions):									
Birth-related	0.1	0.3	11.1	0.2	0.5	10.6	0.2	0.7	13.0
Method-related	1.2	0.8	0.8	1.2	0.8	0.8	1.2	0.8	0.8
Total deaths	1.3	1.1	11.9	1.4	1.3	11.4	1.4	1.5	13.8
Oral contraceptives (with predisposing conditions):									
Birth-related	0.1	0.3	11.1	0.2	0.5	10.6	0.2	0.7	13.0
Method-related	1.4	1.0	1.0	1.4	1.0	1.0	1.4	1.0	1.0
Total deaths	1.5	1.3	12.1	1.6	1.5	11.6	1.6	1.7	14.0
IUDs:									
Birth-related	0.1	0.2	8.0	0.2	0.4	7.7	0.2	0.5	9.5
Method-related	0.5	1.0	1.5	0.5	1.0	1.5	0.5	1.0	1.5
Total deaths	0.6	1.2	9.5	0.7	1.4	9.2	0.7	1.5	11.0
Tubectomy:									
Birth-associated				0	0	0.4	0	0	0.5
Method-associated[a]				0.5	0.9	2.3	0.6	1.2	3.0
Total deaths				0.5	0.9	2.7	0.6	1.2	3.5

	Age group/country type								
	30-34			35-39			40-44		
Regimen	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II
No method:									
Birth-related	13.8	20.0	199.7	21.0	34.2	171.0	22.6	35.9	191.5
Oral contraceptives (no predisposing conditions):									
Birth-related	0.4	1.2	12.0	0.6	1.8	9.2	0.5	1.3	7.1
Method-related	1.9	1.3	1.3	4.0	3.0	3.0	7.3	5.5	5.5
Total deaths	2.3	2.5	13.3	4.6	4.8	12.2	7.8	6.8	12.6
Oral contraceptives (with predisposing conditions):									
Birth-related	0.4	1.2	12.0	0.6	1.8	9.2	0.5	1.3	7.1
Method-related	11.4	6.0	6.0	28.8	13.0	13.0	103.8	63.0	63.0
Total deaths	11.8	7.2	18.0	29.4	14.8	22.2	104.3	64.3	70.1
IUDs:									
Birth-related	0.4	0.9	8.7	0.6	1.3	6.6	0.5	1.0	5.1
Method-related	0.8	1.5	2.3	1.0	2.0	2.0	1.0	2.0	3.0
Total deaths	1.2	2.4	11.0	1.6	3.3	8.6	1.5	3.0	8.1
Tubectomy:									
Birth-associated	0	0	0.4	0	0	0.4	0	0	0.2
Method-associated[a]	0.9	1.7	4.4	2.3	4.6	11.5	13.3	26.7	66.7
Total deaths	0.9	1.7	4.8	2.3	4.6	11.9	13.3	26.7	66.9

	Age group/country type								
	15-19			20-24			25-29		
Regimen	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II
Traditional contraception[b]:									
Birth-related	0.6	1.5	53.0	0.9	2.3	46.6	1.2	2.8	56.5
Abortion:									
Method-related	1.2	2.4	6.0	1.6	3.2	8.0	1.6	3.2	7.9

Table 20.—Annual Number of Birth-Related and Method-Related Deaths per 100,000 Nonsterile Women, by Fertility Planning Method, Age, and Development of Country—Continued

	Age group/country type								
	15-19			20-24			25-29		
Regimen	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II
Traditional contraception[b] and abortion:									
Method-related	0.1	0.2	0.6	0.1	0.4	0.9	0.1	0.4	0.9

	Age group/country type								
	30-34			35-39			40-44		
Regimen	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II	MDC	LDC-I	LDC-II
Traditional contraception[b]:									
Birth-related	2.2	5.2	52.3	2.9	8.1	40.8	2.4	6.3	33.7
Abortion:									
Method-related	2.0	4.0	10.1	1.7	3.4	8.5	1.5	3.0	7.4
Traditional contraception[b] and abortion:									
Method-related	0.2	0.5	1.2	0.1	0.4	0.9	0.1	0.3	0.7

[a] Mortality during the year of procedure divided by remaining years of fertility.

[b] Other methods not listed; e.g., barriers, spermicides, rhythm, and douches.

LDC-I—Middle income LDCs where maternal mortality is relatively high; e.g., South Korea and Taiwan.

LDC-II—Lower income LDCs where maternal mortality is very high; e.g., Bangladesh and Ethiopia.

SOURCE: M. Potts, P. Diggory, and J. Peel, *Abortion*, (Cambridge, England, Cambridge University Press, 1977), p. 575.

opment of specific versions of new technology (4,7). These views, from personal consultations, mail surveys, and reviews of literature, were brought together in a comprehensive assessment of prospective technologies by a senior scientist as a working paper for this study, which was in turn submitted for critique by external reviewers. The paper reviews each major category of fertility planning technology and examines its current level of development, nature of action, mode of administration, probable effectiveness, probable side effects and safety, delivery requirements, probable cost, probable extent of use, likely time frame for development, and obstacles to development (7).

The predictive power of these forecasts depends on the assumption that current trends continue. Such unforeseen developments as funding changes, toxicity findings, or alterations in cost factors could intervene to retard or even curtail the development of particular technologies. It is also impossible to foresee the scientific discoveries that almost certainly will emerge during the next two decades, giving rise to entirely new opportunities for technology development or to greatly accelerated development of methods now under study.

Developments arising from one category of methods—folk methods—deserve special mention. They are not treated further in the discussion to follow because the methods are diverse, and their bases poorly understood. The World Health Organization (WHO) is conducting a collaborative global effort to identify and develop the potential antifertility agents present in plants believed (and used) in numerous LDCs to prevent pregnancy. Among the compounds thus far isolated are extracts from the plant *Montanoa tomentosa,* which has been used as an early abortifacient in Mexican folk medicine for centuries, and from the roots of *Trichosanthis kirilowii maxim,* which has long been used in Chinese medicine to induce menstruation. The likelihood of developing new fertility planning techniques from these sources is unknown, but the potential is unquestionably present. *Gossypol,* a derivative of the cottonseed plant, induces male infertility and is currently under clinical investigation in China as a male contraceptive, but significant side effects, including potassium depletion and delayed return to fertility, have been encountered in studies of the extract.

Between now and the end of the century, more than 20 new or significantly improved technologies for contraception could become available. They have been classified in table 21 in three categories: 1) technologies highly likely to become available by 1990; 2) technologies that could become available by 1990, but for which prospects are in doubt; and 3) technologies that are unlikely to become available by 1990, but which could emerge by 2000 (19,7).

Table 21.—Future Fertility Planning Technologies

Highly likely before 1990

1. Safer oral contraceptives
2. Improved IUDs
3. Improved barrier contraceptives for women
4. Improved long-acting steroid injections
5. Improved ovulation-detection methods for use with periodic abstinence
6. Steroid implants
7. Steroid vaginal rings
8. LRF-analog contraceptives for women
9. Prostaglandin analogs for self-administered induction of menses

Possible by 1990 but prospects doubtful

1. Monthly steroid-based contraceptive pill
2. Improved monthly steroid injection
3. New types of drug releasing IUDs
4. Minidose vaginal rings
5. Antipregnancy vaccine for women
6. Improved barrier contraceptives for men
7. Sperm suppression contraceptives for men
8. Reversible female sterilization
9. Simplified female sterilization techniques
10. Simplified male sterilization techniques
11. LRF analogs for self-administered induction of menses

Unlikely by 1990 but possible by 2000

1. Antifertility vaccine for men
2. Antisperm drugs for men
3. Antisperm maturation drugs for men
4. Lactation-linked oral contraceptives for women
5. Ovulation prediction methods for use with periodic abstinence
6. New types of antiovulation contraceptive drugs for women
7. Contraceptive drugs for women that disrupt ovum transport
8. Reversible male sterilization
9. Pharmacologic or immunologic sterilization for women
10. Pharmacologic or immunologic sterilization for men
11. Agents other than LRF analogs for self-administered induction of menses

SOURCE: Office of Technology Assessment survey; S. B. Schearer and M. K. Harper, 1980.

METHODS HIGHLY LIKELY TO BE AVAILABLE BY 1990

All of the technologies listed below meet two conditions. They are already in advanced stages of research and development, and the scientific and technical knowledge required to complete their development and to permit their manufacture and distribution appears either to be in hand or easily attainable.

Safer Oral Contraceptives.—New versions of the contraceptive pill are being tested that will cause fewer changes in the body metabolism, either because they utilize a smaller amount of contraceptive drug (e.g., the triphasic pill), because they avoid the peak blood levels of drug that occur following ingestion of current pills, or because the effect of the drug is more focused on a specific target or end point. It is assumed that this will reduce the incidence of circulatory system disease, liver hepatomas, and other rare long-term side effects shown to be associated with current formulations of oral contraceptives.

Improved IUDs.—Three improved types of IUDs are anticipated before 1990. The first are advanced versions of the copper-releasing IUDs introduced in the mid-1970's. The improved versions will be effective longer than current IUDs and will not require replacement during the lifetime of the user. The second are advanced versions of the progestin-releasing IUD introduced in the late 1970's. By employing different, more potent contraceptive steroids, the new versions will be much more effective—possibly equaling the pill—and will not require replacement more often than every 5 to 10 years. These new IUDs may cause much less bleeding than existing models, but questions of long-term safety will be present because they release drugs. The third new types are postpartum IUDs—devices that can be safely inserted immediately following delivery without excessively high expulsion and pregnancy rates. They would enable intrauterine contraception to be made available to large numbers of women in LDCs who otherwise might not have access to the medical personnel needed for insertion of other types of IUDs.

Improved Barrier Contraceptives for Women.—Improvements center on two areas: increases in convenience of use and increases in contraceptive efficacy. Among the former are one-size-fits-all diaphragms, disposable diaphragms, spermicide-impregnated diaphragms, vaginal films, vaginal sponges, vaginal rings that release spermicides, and cervical caps that can be left in place for weeks or months. Increases in contraceptive efficacy include new formulations of existing spermicides and new types of spermicides. Which of these are likely to survive the R&D process and become new products is uncertain. Because the level of resources being devoted to this work is very low, progress is likely to be slow, and major improvements are unlikely. A substantially increased level of effort would be required to develop highly effective new spermicides or radically improved barrier devices by 1990.

Improved Long-Acting Steroid Injections.—A wide variety of improved injections under development make use of controlled release of contraceptive steroids from biodegradable polymers. Which polymer systems will prove most useful is not certain, but prospects are excellent that one or more will provide the basis for a new form of contraceptive injection. Effectiveness should be extremely high, and duration of action is likely to be between 1 and 6 months, depending on the properties of the polymer system eventually selected. Side effects are expected to be moderately reduced over existing long-acting injections because of a more stable, controlled release of contraceptive steroid. However, the nature of side effects, including alterations in menstrual bleeding patterns in many users, is expected to be similar to those of existing products.

Improved Ovulation-Detection Procedures for Use With Periodic Abstinence Methods.—Although R&D investments continue to be small, technological prospects for development of a routinized, simple test for ovulation appear good. A wide variety of biological and biochemical parameters are altered when a woman ovulates, and researchers are endeavoring to improve or simplify the physical tests that a woman can use herself to determine when she ovulates. Improved methods that provide clear-cut evaluation of, for example, changes in cervical mucus, hormones in urine and saliva, and basal body temperature would enable larger numbers of users of periodic abstinence to know with certainty when they could safely engage in sexual intercourse during the second half of the menstrual cycle without risk of pregnancy, although the *prediction* of ovulation is likely to remain problematic. Such techniques would also free users of barrier contraceptives, withdrawal, or coitus reservatus from the need to employ these methods during the second half of the cycle. The excretion pattern of urinary metabolites of estrogen and progestogen has been identified and has been successfully used to determine when ovulation has occurred, according to studies conducted by the WHO Special Programme of Research, Development and Research Training in Human Reproduction, which reports that the measurement of these substances in early morning urine was indicative of ovulation in 90 percent of women tested. A number of firms are working to develop a kit for women to use at home, and at least one of the methods is expected to be ready for testing when final analysis of the studies is completed later this year (10).

Steroid Implants.—This new, reversible contraceptive method is likely to undergo several rounds of technological innovation between now and 1990. The first generation product—six steroid-releasing capsules implanted in the forearm providing extremely effective contraception over 5 years—is likely to be either supplemented or supplanted by second generation products employing fewer and smaller capsules that are biodegradable. The first generation product is now being introduced in LDCs and will offer an alternative to sterilization for women who wish to terminate births, as well as a new contraceptive option for long-term spacing between births. While the second generation implants will not require removal, thus eliminating a major drawback of the silicone rubber implants, they will probably need to be replaced at much more frequent intervals than the six-capsule silicone-rubber method. It is likely that a variety of products lasting from 6 months to 2 years will be available. All of these methods are expected to be at least as effective as oral contraceptives and to have a similar incidence and range of side effects. They are expected to have the disadvantage of causing irregular patterns of menstrual bleeding in most users, much the same as do the injectables.

Steroid Vaginal Rings.—As for the implants, this new reversible contraceptive method employs a previously unused system to administer steroid hormones. A one-size-fits-all silicone rubber ring that releases an ovulation-suppressing dose of contraceptive steroids is left inside the vagina for 3 weeks, then removed for 1 week, during which time menstruation occurs. Because this is a monthly schedule and estrogens as well as progestins are used, menstrual bleeding patterns are not greatly altered. This new method offers an alternative to the pill: it is self-administered, highly effective, potentially available over-the-counter, and has the advantage of simplified administration in comparison with daily pill-taking. The method is likely to have at least some of the rare long-term side effects of pills. As with implants, this method is in advanced development, and second generation products are therefore also likely to emerge before 1990. Second generation vaginal rings are likely to have improved administration schedules, such as continuous wearing of the ring for long periods, and new ring designs that offer advantages in price and convenience.

LRF-Analog Contraceptives for Women.—Although this prospective new contraceptive method has only recently entered clinical testing, relatively extensive R&D investments and a high level of technological promise may make it available during the next 10 years. Many modes of antifertility action for new chemical analogs of LRF are being investigated. The one that stands out as most clearly feasible is reversible inhibition of ovulation using chemically synthesized agonists or antagonists of the naturally occurring LRF. It is not yet clear whether these drugs will be given by injection, nasal spray, suppository, buccal insert, or oral capsule, nor is the duration or frequency of administration that will be required yet known. It is anticipated, however, that these new contraceptives will offer a major new alternative to the pill, with the advantages of many fewer short-term side effects and, at least potentially, many fewer long-term health hazards. Depending on which chemical analogs are employed and their precise mode of action, the new contraceptives could also offer the advantage of monthly in place of daily administration.

Prostaglandin Analogs for Induction of Menses.—After more than a decade of R&D, the first prostaglandin analogs for inducing menstruation are now being introduced in clinical trials. These drugs, which are administered as vaginal suppositories, successfully induce abortion during the first 8 weeks of pregnancy in about 90 percent of cases. Side effects—transient fever, nausea, vomiting, and cramping—are generally manageable, although disagreeable. Second and third generation products are likely to emerge over the course of the next decade: new uterotonic prostaglandin analogs and formulations that are effective in bringing about a complete abortion in over 95 percent of cases and that cause fewer side effects. However, it is doubtful that these agents, which depend on uterine muscle contraction for their action, will ever be 100 percent effective or completely free of gastrointestinal side effects. These drugs can be used in place of surgical abortion during early pregnancy if surgical facilities are available to treat severe complications and to surgically complete the abortion procedure in cases where the medication fails to do so.

METHODS THAT COULD EMERGE BY 1990, BUT FOR WHICH PROSPECTS APPEAR DOUBTFUL

The following technologies are possibilities currently being investigated or seriously considered by R&D groups. Some of them are in advanced stages of development.

It is likely that the majority will be eliminated as realistic prospects during the next 10 years as new information and R&D findings become available. A number will survive as continuing prospects and be carried forward into the following decade for additional R&D to complete their development. A few might meet with greater success and emerge as new technologies during the course of the next decade.

Monthly Steroid-Based Contraceptive Pill.—New developments in technology for formulating sustained-release preparations of contraceptive steroids may be put to use to develop a pill that need only be taken monthly. Effectiveness would be expected to be about equivalent to daily oral contraceptives. Short-term side effects would be similar, although a somewhat greater incidence of altered menstrual patterns might occur. Long-term effects would also be similar. The primary advantage of this new pill would be the added convenience offered by monthly use.

Improved Monthly Steroid Injection.—As for the pill, a monthly injection would use new sustained-release formulation techniques to deliver a monthly dose of estrogen and progestin sufficient to block ovulation and produce a hormonally induced menstrual bleeding at the end of the month. Such new monthly injections might be superior to existing ones in their much lower incidence of menstrual bleeding alterations, in their use of steroids compatible with U.S. Food and Drug Administration toxicity standards, and perhaps in a slightly reduced incidence of such short-term side effects as headaches and weight gain Effectiveness and the general spectrum of short- and long-term side effects would be similar to those associated with daily oral contraceptives. Costs would likely be somewhat higher.

New Types of Drug-Releasing IUDs.—Several current R&D projects are testing drugs that reduce menstrual bleeding and uterine cramping associated with the IUD. It is likely that one or several of these drugs will eventually be incorporated into a drug-releasing IUD that will cause significantly less bleeding and discomfort than existing IUDs. Another type of drug that may be incorporated into IUDs is antibiotics. Low doses of such agents released locally into the uterus would reduce the incidence of pelvic infection associated with IUDs, thus overcoming one of the major drawbacks of this contraceptive method, especially for young women. None of the new varieties of drug-releasing IUDs is likely to incorporate the improvements in effectiveness anticipated for the new copper-releasing and steroid-releasing IUDs.

Minidose Vaginal Rings.—Minidose rings, while similar to the steroid-releasing vaginal rings that inhibit ovulation described earlier, would employ much lower doses of progestational steroid and no estrogen. Like the minipill, they would exert their contraceptive action primarily through effects on cervical mucus instead of on ovulation. Minidose vaginal rings would offer the advantage of reduced short- and long-term side effects except with respect to menstrual bleeding patterns, which would probably be significantly changed in most users. Another major advantage of this method over the ovulation-suppressing rings would be its continuous use by a woman, avoiding the complexities of a 3-week in, 1-week out schedule. A major drawback would be lower effectiveness, probably in the range of the present-day minipill or inert-IUD contraceptives.

Antipregnancy Vaccine for Women.—This prospective, reversible contraceptive method uses a vaccine to immunize women against the hormone in a specific component of the fertilized egg, such as the zona pellucida. Initially, a series of injections would probably be needed over a period of several weeks or months to establish immunity. Immunity might last from 1 to several years and then disappear unless a booster injection were given. Effectiveness of a vaccine contraceptive is theoretically very high. A number of different antigens are being investigated for use in developing such a vaccine, and tests in monkeys and women have shown the feasibility of several of these. This is one of the prospective future methods that could benefit from greatly expanded R&D efforts, since feasibility appears good, but a wide range of technical problems needs to be overcome to realize this potential.

Improved Barrier Contraceptives for Men.—Although very little R&D is currently under way in this area, a growing market for barrier contraceptives could stimulate significant innovation over the course of the next decade. Present R&D centers on biodegradable condoms, spermicide-impregnated condoms (already marketed in Great Britain), and penile films. The goal is to overcome the drawbacks of decreased sensation, problems of disposal, and variable effectiveness associated with existing condoms. The scale of this effort is very small, however, as condoms are already an acceptable and effective method. But it is possible for radically improved condoms to be available by 1990 if private sector companies respond to the new market demand by investing in R&D using new synthetic materials.

Sperm Suppression Contraceptives for Men.—For almost a decade, different drugs have been tested for their capacity to suppress sperm production in men. At least two types of drugs—steroids and LRF analogs—are currently under clinical study, and other agents are being investigated in the laboratory. A future sperm-suppressing contraceptive based on one of these agents would for the first time offer men a means of contraception similar to the pill for women. Depending on the type of drug used, it could take the form of a daily, weekly, or monthly pill or, possibly, a long-acting injection or implant. Concerns about possible rare or long-term safety hazards (e.g., teratological effects in any offspring) associated with such a new form of treatment will be important and difficult to overcome.

Reversible Female Sterilization.—Short of extremely expensive and highly uncertain tubal reconstruction surgery, female sterilization is rarely reversible. This major limitation could be overcome if current R&D efforts using fimbrial hoods, tubal plugs, or other methods that permit easy reversal of sterilization are successful. Numerous technical problems remain to be solved, however, before a highly effective, safe, and reversible means of female sterilization is developed.

Simplified Female Sterilization Techniques.—At least three ~~major~~ lines of R&D work are being undertaken in hopes of developing an outpatient method for female sterilization that could be performed by ancillary medical personnel. All of the methods require entry into the uterus via the vagina and cervix in order to apply sclerosing (scarring) chemicals or to use freezing temperatures to destroy a portion of the fallopian tubes. Technical problems in assuring high effectiveness, safety, and freedom from subsequent ectopic pregnancies stand in the way of successful development of these methods. These methods could make sterilization much more widely available to women in LDCs at lower cost and in a manner not requiring hospital stays or surgery.

Simplified Male Sterilization Techniques.—Vasectomy is already performed as a simple outpatient technique with very low rates of morbidity or medical complications. One modest improvement being studied entails the injection of a sclerosing chemical into the vas deferens, thus eliminating the need for opening the scrotum and cutting and tying off the vas.

LRF Analogs for Self-Administered Induction of Menses.—A pill ~~that~~ can be taken each month at the expected time of menstruation to ensure that bleeding will occur whether or not a pregnancy has been established is under study. Such a self-administered, menses-inducing agent might also be effective as an abortifacient if taken up to a week or two after a missed period. New uterotonic prostaglandin analogs are likely to offer some but not all of these features. For ~~complete effectiv~~eness, a luteolytic agent (one that destroys the corpus luteum) will probably be needed, and current research findings point to LRF analogs as the most likely future candidates.

METHODS UNLIKELY TO EMERGE BY 1990, BUT WHICH COULD BE AVAILABLE BY 2000

The following methods are either in the early stages of development or still the subject of mission-oriented research. All appear unlikely to emerge as new fertility planning methods earlier than 1990, but could become available over the course of the following decade. For several, greatly expanded R&D programs could accelerate their development. For several others, it is likely that substantial additions of knowledge from basic research will be needed as a precondition for successful R&D efforts.

Antifertility Vaccine for Men.—Although little R&D has yet been conducted on a male contraceptive vaccine, this area could benefit very substantially from work on a vaccine for women. In men, immunity would be established against sperm or sperm production in a manner that would render the man infertile. Suitable antigens for such a vaccine have not yet been identified. Whether such a vaccine would be a reversible contraceptive or a permanent sterilization technique is not known.

Antisperm Drugs for Men.—A moderate amount of goal-oriented research has been conducted to identify enzymes essential to the metabolism of sperm, and research for inhibitors of these enzymes has been undertaken. It is possible that specific metabolic processes in sperm could be halted by certain drugs that men could take on a regular basis. A reversible male contraceptive agent in the form of a daily or weekly pill might be developed using this principle.

Antisperm Maturation Contraceptive Drugs for Men.—Such drugs would act on maturing sperm rather than on fully active sperm. If specific steps in the maturation process can be identified that could be blocked by specific drugs, a reversible contraceptive could be developed. Administration would need to be on a daily or weekly basis or by means of a sustained-release formulation such as an implant or injection.

Lactation-Linked Oral Contraceptives for Women.—Efforts to develop a drug regimen that could be administered to breastfeeding women to extend both the duration and ovulation-suppressing intensity of their lactation after childbirth have been unsuccessful. In view of the great health benefits of breastfeeding and the very widespread reliance on this as a means of birth spacing by women in LDCs, this remains a high priority technological goal. Recent findings about LRF and other gonadotropin-releasing factors may make it feasible.

Ovulation Prediction Methods for Use With Periodic Abstinence.—The development of simple techniques for predicting when ovulation will occur would permit the rhythm or natural family planning methods to be practiced with full effectiveness. The development of such techniques is beyond the capacities of current scientific knowledge, but prospects a decade from now should be much better.

New Types of Antiovulation Contraceptive Drugs for Women.—Intensive basic and goal-oriented research is under way on factors required for maturation of the ovum in the ovary. If maturation could be prevented, either through direct action or via inhibition of FSH release by the pituitary gland, ovulation would not occur. Prospects that future contraceptives employing a synthetic "inhibin" or chemical analog of an ovum maturation factor will eventually emerge from this research appear good. If such efforts are successful, a new type of nonsteroidal monthly pill or injection for women could result.

Contraceptive Drugs for Women That Disrupt Ovum Transport.—It is known that the transport of the newly fertilized egg and its implantation in the uterus can be disrupted by high doses of estrogens, and this is believed to be the mode of action of the current postcoital pill. A radically improved postcoital pill that could be taken after every coitus without unpleasant side effects or disruption of the menstrual cycle might be developed in the future, using new drugs that interfere with fertilization, ovum transport, or implantation. Despite considerable research, however, no promising agents have yet been identified, and extensive basic and goal-oriented research will be required to achieve this goal.

Reversible Male Sterilization.—Vasectomy is safe, easy to perform, and highly effective. Easy reversal of this procedure to restore fertility would probably have great impact in making the method more widely used. Unfortunately, numerous R&D projects to develop tubes, valves, plugs, and other devices that could be implanted in the vas deferens and reversibly block sperm from passing have ended in failure, so the biological feasibility of a reversible technique is uncertain. New surgical techniques coupled with new biocompatible synthetic materials are likely to be required for development of such a method.

Pharmacologic or Immunologic Sterilization for Women.—A pill or injection that confers permanent infertility has been part of the folklore of many cultures. While toxicity concerns would have to be resolved, if sufficient R&D were devoted to a careful selection of proper pharmacologic or immunologic agents, high safety and effectiveness should be attainable. The method could be based on drugs that destroy the capacity of the ovaries to produce viable ova or on an immunization against a body protein that is essential for reproduction. Although the method could be effective following a single administration, it is more likely that a series of administrations of the drug or vaccine would be needed. Such a method would offer a low-cost, noninvasive alternative to surgical sterilization.

Pharmacologic or Immunologic Sterilization for Men.—Analogous to the method for women summarized above, this prospective future technology would produce sterility in the male by using drugs that permanently eliminate sperm production or a vaccine that permanently blocks male fertility. Both types of agents are already known, but no significant R&D program has been established to develop them into a male sterilization technique. As for the female method, considerable research would be needed to assure both safety and effectiveness. Since vasectomy is already a simple technique, the advantages of a pharmacologic or immunologic male sterilization method are less dramatic than those associated with a similar method for women.

Agents Other Than LRF Analogs for Self-Administered Induction of Menses.—A variety of agents are being investigated for this purpose: luteolytic prostaglandin analogs, plant extracts, chemicals that bind to different types of hormone receptors, and antibodies that could be administered by injection as a one-time, passive immunization.

Induced abortion

Natural or spontaneous abortion occurs in about one in five known pregnancies. However, the loss of fertilized ova prior to or immediately following implantation is much higher. The combined total may be as high as 70 percent of all fertilized ova (20). Many of these spontaneous abortions are due to defective fetuses, such as those with chromosomal abnormalities.

Induced abortion is a medically safe procedure when performed early in pregnancy (first trimester) by skilled personnel. Simple suction equipment, such as that developed in rural China, and manual syringe equipment for office use, such as that developed in the United States, have begun to replace the primitive methods traditionally used in less developed regions. But the risks of maternal death or serious complications increase greatly when induced abortion is performed later in pregnancy, and also when the quality of personnel and facilities is lowered.

Although induced abortion is ubiquitous, its legal use is constrained in some countries by religious beliefs. The limitations of current contraceptive technologies, particularly lack of access to their use, cause many women in all parts of the world to seek induced abortions to terminate unwanted pregnancies. Abortion is not a preferred method of birth control but at times is the only means of preventing an undesired birth. The large numbers of women who seek abortions are more an index of how strongly births are not wanted and contraception is needed than an indication of the preference for abortion.

Sterility prevention or reversal

Unwanted sterility is due to a wide range of etiological factors; e.g., infection of the fallopian tubes with venereal disease; lack of ovulation; defective sperm production; developmental-abnormalities of the uterus; the effects of repeated or improperly conducted abortions, such as injury to the cervix; etc.

Except for a few congenital defects, the principal criterion for the diagnosis of sterility is failure of a couple to achieve pregnancy after a significant period (e.g., 2 years) of cohabitation without practicing contraception. Worldwide infertility has been estimated as involving 5 to 10 percent of couples (25). The prevalence of sterility rises from a low of 3 to 4 percent among young couples, to 20 percent among couples in their early 30's, and rapidly to 100 percent (menopause) during the woman's 40's. In some areas, as in parts of sub-Saharan Africa, sterility from infectious diseases is common enough to lower birth rates and to be a major reason for seeking medical care. In Zaire, for example, the high prevalence of sterility caused by venereal infections was documented in the 1950's in association with lower than expected birth rates. Following effective efforts to reduce venereal diseases, the occurrence of sterility was markedly reduced and birth rates rose (18).

Several technological innovations could have a major impact on the capacity to diagnose the causes of infertility. These include development of reliable, simple techniques for predicting as well as for confirming ovulation; development of similar tests for determining the level of functioning of the male seminiferous tubules; and further development of ovulation-inducing drugs to verify the woman's capacity for ovulating.

In women, the major preventable cause of infertility is infection leading to damage of the fallopian tubes. A variety of public health measures can reduce the incidence of such infections, including control over the transmission of venereal disease and, in some countries, prevention of tuberculosis. Two technological developments could be significant: the development of IUDs associated with a lower risk of pelvic inflammatory disease, and the development of vaccines against venereal diseases.

New technologies likely to be extremely useful for inducing fertility in couples are LRF agonists for inducing ovulation and LRF agonists and other possible releasing-factor analogs for increasing sperm production. For some couples, infertility in one partner cannot be treated, and assistance will only be possible in the form of adoption, use of another person's sperm via artificial insemination, or use of in vitro fertilization followed by embryo transfer to the uterus. These technologies now exist but are expected to benefit from improvements in sperm banking and techniques for artificial insemination, and from new developments in ovum extraction, in vitro fertilization, and embryo implantation. These techniques, however, are expected to have little global impact on the treatment of infertility.

Sex selection

Sex selection is included as a fertility planning technology in this study because a strong preference for sons persists in many LDCs, scientists are working on new technologies, and the probable impacts of effective technologies could be highly disruptive and contrary to rising expectations of sexual equality.

The evidence for sex preferences in different parts of the world is well documented in descriptions of the divisions of power and labor between men and women and in such practices as female infanticide (see ch. 7). Despite political actions of a few countries like China to eliminate preference for males by raising the status of women, it seems likely that a simple, effective technology for sex selection would be widely used.

Current technologies are highly ineffective for sex selection short of performing amniocentesis to ascertain the sex of the developing embryo and then carrying out a second trimester abortion if the embryo is of the unwanted sex.

Noninvasive techniques for sampling cells of early embryos might emerge in the next 20 years, enabling much earlier determination of sex. This would make possible the choice of first trimester abortion if the sex were unwanted, but any such technological advances would face strong social, political, and ethical pressures against the use of induced abortion for what most perceive to be a trivial purpose.

A second approach to sex selection that has been the subject of limited research entails separation of sperm into male-determining sperm (those bearing Y chromosomes), and female-determining sperm (those bearing X chromosomes), followed by artificial insemination with the desired sperm. While this approach might be more acceptable, prospects for developing highly effective sperm separation techniques are limited and even if these existed, the need to employ artificial insemination would almost certainly prevent this from becoming a generally used procedure.

Claims that certain chemicals present in the vagina at the time of ejaculation or that the timing of intercourse during the menstrual cycle could affect the sex of the offspring have proved largely unfounded. Nonetheless there exists a remote possibility that a chemical or immunological agent might be discovered that would differentially destroy male- or female-determining sperm. If such a substance were to be developed, a male pill or injection or a vaginal preparation for selecting the sex of the offspring could become a practicable reality. In view of the lack of research aimed at this objective, the serious social questions about the value of sex selection, and uncertainty of an MDC market for sex selection products, it is highly unlikely that a product for general use will become available by 2000 A.D.

The need for better fertility planning technologies

Each existing fertility planning method has one or more serious limitations, such as mode of administration, interference with coitus, need for frequency of use, cost (a significant factor in LDCs), requirements for special personnel and facilities, and conflicts with cultural, religious, and medical norms. Side effects of IUDs and steroids are sufficient to discourage adoption by some women and discontinuation of use by many.

One-year discontinuation rates in LDCs are high for both the pill (60 percent) and the IUD (40 percent) (11). These and other methods can be inappropriate for use in many settings. Pills can be misused by being taken irregularly or in the wrong sequence, resulting in low effectiveness, and because the mode of action of IUDs is not well understood, the devices are sometimes suspected of "migrating" to other parts of the body by women in LDCs. Changes in menstrual duration and flow sometimes cause fears, as do reports of death and injury from various methods. Requirements of vaginal methods for clean water and a degree of privacy can deter their use in LDCs.

Many methods require medical personnel for delivery and follow-up care, and because their use is not well-researched for LDC groups, relative risks are unknown. A number of methods require logistical support systems that are beyond the capacities of many LDCs, where refrigeration, transport, and storage facilities may be inadequate. The complexities of many methods require high levels of scientific and technical sophistication for their selection, procurement, and delivery. The difficulty of sterilization reversal remains a principal drawback despite improvements in surgical techniques, and no method other than periodic abstinence is acceptable to the Roman Catholic Church.

The failure rate, or inability of the method to accomplish its primary purpose of preventing unwanted pregnancy, is a critical shortcoming. Even in MDCs, where levels of use of the most effective methods are high, contraceptive failure continues to result in large numbers of unwanted births and large numbers of induced abortions. Some 500,000 babies are born in the United States each year to parents who did not want them, and an approximately equal number of induced abortions are reported for married women (6).

It is clear that although current fertility planning methods are far superior to those of just 20 years ago, they remain inadequate to the needs of MDC users and fall critically short of the needs of couples in LDCs. When the lifetime needs of both MDC and LDC couples—who will require an effective, safe, reversible, easy-to-use contraceptive method for 20 to 25 years of their lives—are taken into account, the disparity between technology and need is greater still. Current methods have considerable unused potential for lowering LDC birth rates in the next 20 years, but cannot yet adequately meet the needs and desires of people either in MDCs or LDCs. When the urgent desire to reduce the incidence of induced abortion is also taken into account, the magnitude of need for better contraceptive technologies cannot be underestimated.

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Chapter 6

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Chapter 6

Reproductive Research and Contraceptive Development

Abstract

Reproductive research and contraceptive development are carried out by academic institutions, the pharmaceutical industry, private foundations, U.S. and foreign governments, and international agencies. U.S. Government support for contraceptive development began in the late 1960's when the National Institutes of Health's (NIH) Center for Population Research and the Agency for International Development's (AID) Office of Population were created. Although worldwide expenditures for reproductive research and contraceptive development rose from $31 million to $155 million between 1966 and 1979, when adjusted for inflation there has been a decline of 20 percent since 1973. Public sector expenditures (by governments and philanthropic and nonprofit organizations) constitute about 85 to 90 percent of these worldwide expenditures. In 1979, the U.S. Government's share of this total was 72 percent or $111.6 million. Government research agencies stimulate private sector initiatives in contraceptive development in two ways. First, they support basic research projects in academic and other nonprofit research institutions. Private firms can then build on these findings to develop new products. Second, Federal agencies can directly finance projects (e.g., clinical trials) that might otherwise require industry financing in order to stimulate industry to develop and market new products.

Before U.S. manufactured drugs and medical devices can be marketed, they must meet the safety and efficacy standards of the laws passed by Congress and administered by the U.S. Food and Drug Administration (FDA). Testing requirements for contraceptives are more stringent than for other drugs because they are used for long periods by healthy individuals rather than by individuals with disease. Drugs not approved for marketing in the United States cannot be exported for use abroad. Medical devices not approved for marketing in the United States can be exported under limited conditions. These export provisions will become more important as pharmaceutical manufacturers shift their marketing efforts from the United States, where population growth is close to replacement level, to the less developed countries (LDCs), where the number of people entering the reproductive ages is increasing. FDA's market approval process has been criticized as shortening effective patent life, leaving manufacturers too little time to recoup their investments. Drug patents run for 17 years, and the market approval process averages 7½ years—8½ years for hormonal contraceptives. However, for the oral contraceptives, patent holders have been able to increase prices and retain a dominant share of the market even after their patents have expired. Liability insurance costs have risen, and, in some cases, pharmaceutical manufacturers have had difficulty in obtaining satisfactory insurance coverage. These product liability problems may be deterring some pharmaceutical manufacturers from the contraceptive products line as well as affecting the kinds of future contraceptives to be developed. Liability problems have also affected the clinical testing that new contraceptives must undergo, as insurance is more difficult to obtain and its cost is substantially higher.

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Introduction

As in other areas of pharmaceutical investigation, reproductive research and contraceptive development are comprised of the following activities:

- basic research (in both the reproductive process and in related fields; e.g., immunology);
- training of scientists;
- applied research (i.e., goal-oriented R&D); and
- evaluation of the safety and effectiveness of methods already in use.

These activities and, in some cases, the introduction and marketing of contraceptives, are carried out in varying degrees by the following entities:

- academic institutions;
- the pharmaceutical industry;
- private foundations;
- the U.S. Government;
- foreign governments; and
- international agencies.

In the following analysis, recent trends in the financing of reproductive research and contraceptive development are discussed. The major public sector organizations involved are described, and selected factors that affect reproductive research and contraceptive development are examined.

Support of reproductive research and contraceptive development

Trends in financial support

Throughout the 1940's and 1950's, contraceptive development was not directly supported by the U.S. Government. Oral contraceptives, for example, were developed with the support of private philanthropy (particularly the Rockefeller Foundation) and the pharmaceutical industry.

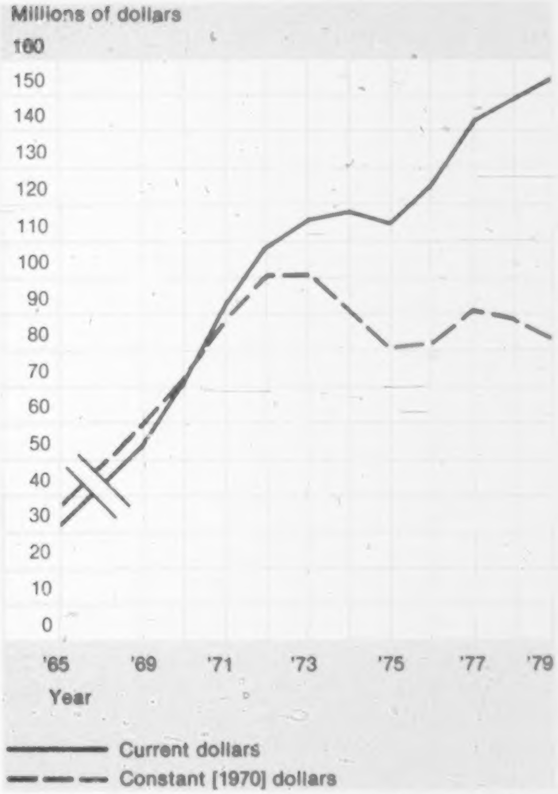
In the late 1960's, the U.S. Government created agencies that eventually began allocating relatively small amounts of research funds to contraceptive development. In 1967 the Office of Population was created within AID, and in 1968 the Center for Population Research was established in the National Institute of Child Health and Human Development within NIH. On the international level, the United Nations Fund for Population Activities (UNFPA) was created in 1969, and in 1972 the Special Programme for Research, Development and Research Training in Human Reproduction was established within the World Health Organization (WHO).

In 1979, worldwide funding for reproductive research and contraceptive development totaled approximately $155 million, an increase from $31 million in 1965. However, expressed in constant (1970) dollars, this $155 million was equal to $82.6 million, and the high point in funding was 1972-73 (fig. 20). There has thus been a decline in these funds of about 20 percent since 1973 (table 22).

During the 1970's, the U.S. contribution remained at approximately 70 percent of the worldwide total; the remaining 30 percent was provided largely by other industrialized nations and by the LDCs (table 22). The U.S. contribution in 1979 was $111.6 million (actual dollars), or 72 percent of worldwide expenditures.

U.S. contributions consist of funds from the U.S. Government, philanthropic and nonprofit organizations, and industry, and there has been a shift in relative contributions among these sources. In the 1960's, these three sources provided roughly equal percentages of the total

Figure 20.—Worldwide Expenditures for Reproductive Research, 1965-79



SOURCE: L. Atkinson, et. al., "Prospects for Improved Contraception," *Family Planning Perspectives*, 12(4), pp. 173-192, 1980.

U.S. contribution, but by the late 1970's, the U.S. Government was by far the major contributor, providing 70 to 80 percent of the total U.S. contribution (table 23). The U.S. Government is thus the major current contributor to reproductive research and contraceptive development, providing more than 50 percent of total worldwide expenditures.

The components of worldwide total expenditures for reproductive research and contraceptive development are summarized in table 24 and figure 21. Worldwide public sector expenditures, by governments and philanthropic and nonprofit organizations, constitute about 85 to 90 percent of total expenditures (table 23). The components of these public sector expenditures are summarized in table 25. Approximately 70 percent of total funds go to basic research and training, 20 to 25 percent to contraceptive development, and less than 10 percent to safety assessments. In contrast, about 80 percent of public sector funds are spent on basic research and training, 10 to 15 percent on contraceptive development, and 10 percent on evaluation of current methods (compare tables 24 and 25). The public sector thus allocates proportionately more funding to basic research and less to contraceptive development than does the private sector.

The proportionate distribution of public sector expenditures in 1978 for contraceptive development (approximately 15 percent of total public sector expenditures) is summarized in table 26. Approximately 71 percent was spent on contraceptive methods for women, 6 percent on methods for men, and 23 percent on methods (such as sterilization) for female or male use. Of the 71 percent of expenditures on methods for women, 37 percent was spent on new approaches to use of steroids, including subdermal implants, improved oral products, injectables, and vaginal rings. Another 10 percent was spent on vaccines against pregnancy. The remaining 24 percent was spent on sterilization methods, antifertility and anti-implantation agents, intracervical and intrauterine devices, menses-inducing and abortifacient drugs, and barrier methods.

Major agencies involved in reproductive research and contraceptive development

The following organizations or scientific institutions currently either finance or conduct reproductive research and contraceptive development, largely for LDCs:

- The Center for Population Research (CPR) was established in 1968 within the National Institute of Child Health and Human Development at NIH. In turn, CPR established its Contraceptive Development Branch, which in 1979 spent about $7 million.
- The International Fertility Research Program (IFRP) was founded in 1971. It con-

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Table 22.—Total Expenditures for Research in the Reproductive Sciences and Contraceptive Development, by Country of Origin, 1965 and 1969-79 (in thousands of current and constant [1970] U.S. dollars)

Country of origin[a]	1965	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Current dollars:												
United States	$25,928	$41,537	$55,009	$71,663	$ 79,724	$ 82,070	$ 79,104	$ 73,992	$ 82,787	$ 97,300	$104,800	$111,600
Other industrialized countries	4,886	11,992	15,267	21,126	28,811	33,039	38,029	39,176	39,720	45,600	44,200	43,200
Developing countries	208	1,017	1,186	1,694	1,689	2,321	1,590	2,385	3,329			
Total	31,022	54,546	71,462	94,483	110,224	117,430	118,723	115,553	125,836	142,800	149,000	154,800
Constant dollars:												
United States	32,010	44,188	55,009	68,906	73,819	71,991	62,287	53,232	56,318	62,300	62,400	59,500
Other industrialized countries	5,992	12,634	15,267	19,908	25,505	27,093	27,771	25,046	23,874	29,200	26,300	23,100
Developing countries	268	1,070	1,186	1,577	1,501	1,873	1,088	1,443	1,912			
Total	38,270	57,892	71,462	90,390	100,825	100,957	91,146	79,721	82,104	91,400	88,700	82,600
Percent distribution of expenditures (based on constant U.S. dollars):												
United States	83.6%	76.4%	77.0%	76.3%	72.4%	69.9%	68.3%	66.8%	68.6%	69.6%	70.3%	72.0%
Other industrialized countries	15.7	21.8	21.3	22.0	26.1	28.1	30.5	31.4	29.1	31.4	29.7	28.0
Developing countries	0.7	1.8	1.7	1.7	1.5	2.0	1.2	1.8	2.3			
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

NOTE: Totals may not add because of rounding.

[a] Countries reporting 1965-74: United States, other industrialized countries—Australia, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Israel, Italy, the Netherlands, New Zealand, Norway and Sweden, developing countries—Africa, Egypt, Hong Kong, India, Iran, the Philippines, South Korea, Thailand and Turkey.
Countries reporting 1975-79 data for governments other than the United States are based on 1976 estimates (e) and reports (r); United States; other industrialized countries—Australia (r), Belgium (e), Canada (r), Denmark (r), Finland (e), France (r), Germany (r), Great Britain (r), Israel (r), Italy (r), Japan (r), the Netherlands (r), New Zealand (e), Norway (r) and Sweden (r); developing countries—Africa (e), Egypt (e), Hong Kong (e), India (r), Iran (e), Latin America (r), the Philippines (e), South Korea (r), Thailand (r) and Turkey (e).

SOURCE: L. Atkinson, et al., "Prospects for Improved Contraception," *Family Planning Perspectives*, 12(4), pp. 173-192, 1980.

Table 23.—Estimated Worldwide Funding for Reproductive Biology and Contraceptive Development, 1965 and 1969-79, by Sector (in millions of constant 1970 dollars and by percent distribution)

Sector	1965	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
United States:												
Constant dollars:												
Government	$11.4	$19.9	$25.3	$32.0	$43.3	$44.6	$38.0	$36.8	$41.4	$44.8	$45.8	$47.7
Philanthropic and nonprofit	8.2	11.1	16.8	22.6	16.9	14.2	12.7	6.2	3.8	8.5	8.3	4.4
Industry	12.4	13.2	13.0	14.3	13.7	13.3	11.7	9.9	9.5	9.0[a]	8.3[a]	7.5[a]
Total	$32.0	$44.2	$55.1	$68.9	$73.9	$72.1	$62.4	$52.9	$54.7	$62.3	$62.4	$59.6
Percent distribution[b]:												
Government	35%	45%	46%	46%	59%	62%	61%	70%	76%	72%	73%	80%
Philanthropic and nonprofit	26	25	25	33	23	20	20	12	7	14	13	7
Industry	39	30	24	21	19	18	19	19	17	14[a]	13[a]	13[a]
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
International												
Constant dollars:												
Governments	$6.2	$13.7	$16.3	$21.2	$24.7	$24.4	$23.3	$24.8	$25.8	$24.3[a]	$22.6[a]	$20.3[a]
Nonprofit	0.07	0.04	0.06	0.26	3.1	4.5	5.4	5.3	4.9	4.8	3.7	2.8
Total	$6.3	$13.7	$16.4	$21.5	$27.8	$28.9	$28.7	$30.1	$30.7	$29.1	$26.3	$23.1
Percent distribution[b]:												
Governments	98%	100%	99%	99%	89%	84%	81%	82%	84%	84%[a]	86%[a]	88%[a]
Nonprofit	2	1	1	1	11	16	19	18	16	16	14	12
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[a] Survey data are not available for after 1976. It is assumed that expenditures remained at 1976 levels.
[b] Totals may not add up to 100 because of rounding.

SOURCE: L. Atkinson, et al., "Prospects for Improved Contraception," *Family Planning Perspectives* 12(4), pp. 173-192, 1980.

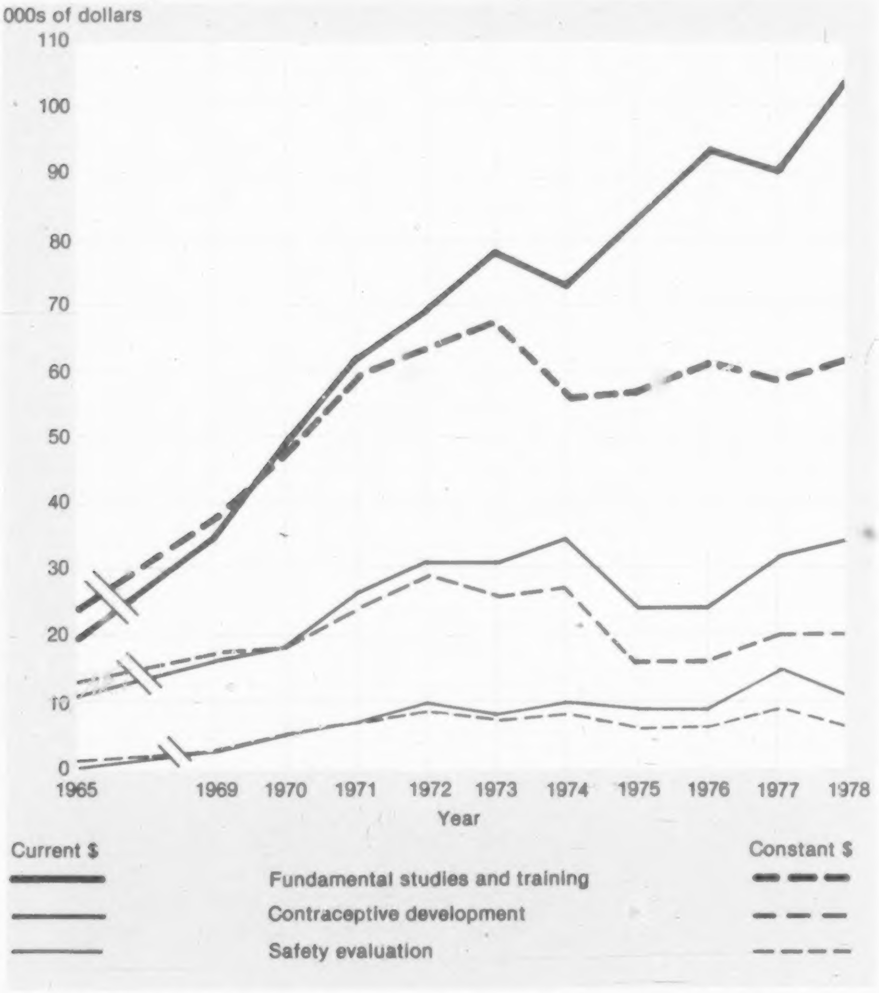
Table 24.—Percentage Distribution of Expenditures in the Reproductive Sciences and Contraceptive Development, by Purpose, 1965 and 1979-78

Purpose	1965	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Fundamental studies/training	62.0	65.0	68.0	65.4	62.6	66.6	61.8	71.8[a]	73.8[a]	68.0	70.1
Contraceptive development	35.3	30.0	24.7	27.1	28.3	26.2	29.5	20.5	19.4	22.0	22.8
Safety	2.7	5.0	7.3	7.5	9.1	7.2	8.7	7.7	6.8	10.0	7.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a] Includes unclassified expenditures.

SOURCE: L. Atkinson, et al., "Prospects for Improved Contraception," *Family Planning Perspectives*, 12(4), pp. 173-192, 1980.

Figure 21.—Worldwide Expenditures for Fundamental Reproductive Studies and Training of Scientists, Contraceptive Development, and Evaluation of Contraceptive Safety, 1965-78 (in 000s of current and constant [1970] U.S. dollars)



SOURCE: L. Atkinson, et al., "Prospects for Improved Contraception," *Family Planning Perspectives*, 12(4), pp. 173-192, 1980.

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Table 25.—Public-Sector Funding for Research in Reproduction and Contraception,[a] 1969-79

Year	Annual public-sector expenditures in millions of current dollars[b]			
	Total	Basic research training, and institutional support[c]	Contraceptive development	Research to evaluate current methods
1969	$ 42.2 (100%)	$ 35.5 (84.1%)	$ 4.0 (9.5%)	$ 2.7 (6.4%)
1970	58.6 (100%)	48.6 (82.9%)	4.8 (8.2%)	5.2 (8.9%)
1971	79.6 (100%)	61.8 (77.6%)	10.7 (13.4%)	7.1 (8.9%)
1972	95.2 (100%)	69.0 (72.5%)	16.2 (17.0%)	10.0 (10.5%)
1973	101.9 (100%)	78.2 (76.7%)	15.3 (15.0%)	8.5 (8.3%)
1974	103.6 (100%)	73.3 (70.9%)	19.9 (19.2%)	10.3 (9.9%)
1975	102.6 (100%)	83.0 (80.9%)	10.7 (10.4%)	8.9 (8.7%)
1976	111.8 (100%)	92.9 (83.1%)	10.3 (9.2%)	8.6 (7.7%)
1977	128.7 (100%)	97.1 (74.5%)	17.3 (13.4%)	14.3 (11.1%)
1978	135.0 (100%)	104.5 (77.4%)	19.9 (14.7%)	10.6 (7.9%)
1979	140.8 (100%)	NA	NA	NA

NA = Not available.

[a] Derived from *Reproduction and Human Welfare: A Challenge to Research*, R. O. Greep, M. A. Koblinsky, F. S. Jaffe, 1976, MIT Press; "Status of Funding and Costs of Reproductive Science Research and Contraceptive Development," L. Atkinson, 1979, in *Contraception: Science, Technology and Application*, National Academy of Sciences; and "Prospects for Improved Contraception," L. Atkinson, S. B. Schearer, O. Harkavy and H. Lincoln, 1980, *International Family Planning Perspectives*, vol. 6, pp. 43-59.

[b] The percentage of the year's total is indicated in parentheses after each figure.

[c] In any given year, over 90 percent is devoted to basic research and less than 10 percent to training and institutional support.

SOURCE: S. B. Schearer, "Contraceptive Development by Public Organizations: An Assessment of Progress and Problems," report prepared for the Office of Technology Assessment, 1980.

Table 26.—Percentage Distribution of Public Sector Expenditures for Development of New Contraceptive Methods, 1978

Type of method	Percent	Type of method	Percent
All female methods	71.2	Menses-inducing and abortifacient drugs	4.5
Steroidal	37.2	Barrier methods	2.2
Subdermal implants	(16.9)		
Improved oral contraceptives	(9.9)		
Injectables	(5.4)	**All male methods**	6.1
Vaginal rings	(4.4)	Systemic	5.5
Intranasal sprays	(0.5)	Reversible sterilization and improved vasectomy techniques	0.6
Vaccines against pregnancy[a]	10.1		
Sterilization	2.0		
Reversible	(0.4)		
Nonsurgical	(1.6)	**Methods for couples and unclassified**	22.7
Antifertility and antiimplantation agents	8.3	Releasing factors[a]	5.1
Intracervical (ICD) and intrauterine (IUD) devices	6.9	Plant agents	3.9
ICDs	(1.6)	Periodic abstinence	4.8
Postpartum IUDs	(1.6)	Other and unclassified	8.9
Other IUDs	(3.7)	Total	100.0

[a] The percentage of total expenditures for releasing factors, derived from 1978 data, is almost certainly higher because of increased interest in this line of research, while the proportion devoted to steroidal male methods and to antipregnancy vaccines has probably decreased because of problems encountered with research on these methods.

SOURCE: L. Atkinson, et al., "Prospects for Improved Contraception," *Family Planning Perspectives*, 12(4), pp. 173-192, 1980.

ducts clinical trials, mainly in LDCs, to develop and adapt new and existing methods of contraception and to evaluate long and short-term risks and benefits of use. IFRP also promotes the building of local research skills and the introduction and use of contraceptive methods. About $3.7 million of IFRP's $5.8 million annual budget is devoted to contraceptive development. IFRP is supported by AID, NIH, and private donors (primarily the Hewlett Foundation).

- The Program for Applied Research on Fertility Regulation was established in 1972 and, through subcontracts, has established its own clinical testing network for new contraceptives. Its annual budget is about $1.9 million, approximately 90 percent of which is provided by AID.
- The International Committee for Contraception Research was founded in 1971 by the Population Council for contraceptive product development. Its $2.7 million annual budget is funded in roughly equal portions by the Rockefeller Foundation, the Ford Foundation, the International Development Research Centre (IDRC) (a Canadian Government agency), and AID.
- The Special Programme of Research, Development, and Research Training in Human Reproduction was established by WHO, a U.N. agency, in 1972. A little over $4 million of its 1979 budget of $16.9 million was allocated to applied contraceptive R&D. Other activities include developing scientific institutions and manpower in LDCs, setting scientific and technical standards, providing supplies and equipment for research, and providing information about the performance of existing family planning programs.
- The Program for the Introduction and Adaptation of Contraceptive Technology (PIACT) was founded in 1976 to serve as a bridge between the clinical researcher and the family planning program manager, and a significant part of its program effort is directed toward introducing new and improved contraceptive technologies into public sector family planning programs. It is currently helping several countries, including the People's Republic of China, establish the local capability to produce the contraceptives they require. PIACT was initially financed largely by the Ford Foundation. About 50 percent of its 1981 budget of over $4 million is provided by UNFPA, approximately 15 percent by IDRC, approximately 30 percent by American private foundations (primarily the Ford Foundation, the Andrew W. Mellon Foundation, and the Hewlett Foundation), and the remainder from other sources.

Factors affecting reproductive research and contraceptive development

Availability of R&D funds from public sector sources

Government agencies now provide most of the funds for reproductive research and contraceptive development. The U.S. Government provides over 50 percent of worldwide funds; other nations contribute about 25 percent (table 27). Philanthropic institutions, nonprofit organizations, and industry provide the remaining 25 percent in roughly equal proportions. Support from U.S.-based philanthropic and nonprofit organizations peaked in 1971-72, while nonprofit organizations in other countries have increased their contributions since that time (table 23). Industry's contributions have remained fairly stable, but its share of total funding has decreased from about 20 to 10 percent (table 27) while government contributions have increased.

Public sector funding has historically been largely devoted to basic research and training. Because funds from these sources increased from about two-thirds of the worldwide total in 1965 to about 90 percent in the late 1970's, funds for this purpose were adequate to keep pace with inflation. However, funds for contraceptive development did not increase enough to offset inflation. Funds for research on safety and other evaluations of current methods rose to about 10 percent of expenditures by 1972

Table 27.—Estimated Worldwide Funding for Reproductive Biology and Contraceptive Development, 1965 and 1969-79, by Sector (in millions of constant dollars and by percent distribution)

Sector	1965	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Constant dollars:												
U.S. Government	$11.4	$19.9	$25.3	$32.0	$ 43.3	$44.6	$38.0	$36.8	$41.4	$44.8	$45.8	$47.7
Other nations	6.2	13.7	16.3	21.2	24.7	24.4	23.3	24.8	25.8	24.3[a]	22.6[a]	20.3[a]
Philanthropic and nonprofit	8.3	11.1	16.9	22.9	20.0	19.7	18.1	11.5	8.7	13.3	12.0	7.2
Industry	12.4	13.2	13.0	14.3	13.7	13.3	11.7	9.9	9.5	9.0[a]	8.3[a]	7.5[a]
Total	$38.3	$57.9	$71.5	$90.4	$101.7	$101.0	$91.1	$93.0	$85.4	$91.4	$88.7	$82.7
Percent distribution[b]:												
U.S. Government	30%	34%	35%	35%	43%	44%	42%	40%	48%	49%	52%	58%
Other nations	16	24	23	23	24	24	26	27	30	27[a]	25[a]	25[a]
Philanthropic and nonprofit	22	19	24	25	20	20	20	12	10	15	14	9
Industry	32	23	18	16	13	13	13	11	11	10[a]	9[a]	9[a]
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[a] Survey data are not available for after 1976. It is assumed that expenditures remained at 1976 levels.
[b] Totals may not add up to 100 because of rounding.

SOURCE: L. Atkinson, et al., "Prospects for Improved Contraception," Family Planning Perspectives, 12(4), pp. 173-192, 1980.

and have remained at approximately that level (see fig. 21).

Basic research is primarily investigator-initiated and administered through grants. The research enterprise has historically emphasized investigator-initiated research, and this emphasis is likely to continue. Contraceptive development and safety and other evaluations of current methods are goal-oriented and usually administered through contracts. In addition, concerns over the safety of drugs and medical devices—concerns that are especially acute in the contraceptive field—translate to pressures to increase safety testing. Contraceptive development thus faces competition for funds not only from basic research activities but also from the burgeoning field of safety assessment.

Government research agencies stimulate private sector initiatives in contraceptive development in two ways. First, they support basic research projects in academic and other nonprofit research institutions. Private firms can then incorporate these research findings into their product development activities. This avenue has recently been enhanced by a new patent law (Public Law 96-517), which contains more liberal provisions for the transfer of patent rights arising from inventions sponsored by the Government. This law creates a uniform set of procedures by which small businesses can gain licenses to develop federally sponsored inventions to which the Government retains title but that were previously left undeveloped. The new law seeks to: 1) use the patent system to promote the utilization of inventions arising from federally sponsored research; 2) encourage maximum participation of small business firms; 3) promote collaboration between commercial concerns and nonprofit organizations (including universities); 4) ensure that inventions made by nonprofit organizations are used to promote competition and free enterprise; (5) promote the commercialization and public availability of inventions made in the United States by U.S. industries and labor; 6) retain by the Government sufficient rights to protect the public against nonuse or nonreasonable use of inventions; and 7) minimize the cost of administering policies in this area.

Second, Federal agencies can directly finance selected research projects that normally would be financed by the industry itself. For example, the National Cancer Institute will conduct animal toxicity tests and clinical trials of anticancer drugs developed by the industry. This is also true for vaccines. The National Institute of Allergy and Infectious Diseases will finance basic and epidemiologic research, as well as clinical trials, to stimulate vaccine manufacturers to develop and market new vaccines (10).

The agency within NIH that finances contraceptive development is CPR in the National

Institute of Child Health and Human Development. In 1979, CPR's Contraceptive Development Branch (CDB) spent about $7 million, about 14 percent of CPR's research budget. Currently, CDB is helping the industry develop three contraceptives (3). For the past 6 years, CDB has jointly financed long-term animal toxicity tests and clinical trials of norethindrone enanthate with Schering A.G., a German pharmaceutical company. CDB will probably continue to help finance clinical testing of this drug through completion of the new drug application (NDA) process. For 3 years, CDB, Alza Pharmaceutical, and WHO have jointly financed the development of a biodegradable implant of a progestin-type contraceptive. CDB began financing a joint effort with Syntex pharmaceutical company in June 1980 to conduct early animal toxicity tests and clinical trials with a luteinizing-releasing factor agonist.

The market approval process

Before U.S.-manufactured drugs and medical devices can be marketed, they must meet the minimum standards of safety and effectiveness established by Congress through a series of legislative actions. The principal laws are:

- The 1906 Food and Drug Act;
- The 1938 Food, Drug, and Cosmetic Act;
- The 1962 Drug Amendments; and
- The 1976 Medical Devices Amendment.

The interpretation of these laws and the enforcement of the standards set are the responsibility of the FDA.

Although postmarketing surveillance is also conducted, U.S. laws are designed to screen drugs and medical devices before they are used by the public, so premarket testing is used to predict whether or not significant harm could occur with human use. FDA regulations thus emphasize the use of predictive methods which, given the state of current scientific knowledge, depend heavily on tests in laboratory animals.

The issues concerning the market approval process and its effect on contraceptive development are generic to FDA's role in the regulation of drugs and medical devices in general, but these issues are especially sensitive in the contraceptive area.

TESTING METHODS

FDA regulations specify the kind and length of tests that must be completed for market approval. Testing requirements for oral contraceptives are more stringent than for other types of drugs because they are used for long periods by healthy individuals rather than by individuals with disease. Table 28 summarizes the animal tests that must be completed before testing in humans can take place and an NDA is submitted. In each phase of testing, the regulations require longer testing periods and more animal species for oral contraceptives than for other drugs: 90-day studies in rats, dogs, and monkeys, v. 2- to 4-week studies in two animal species prior to Phase I; 1-year studies in rats, dogs, and monkeys v. 90-day studies in two animal species prior to Phase II; 2-year studies in rats, dogs, and monkeys, and initiating 7-year

Table 28.—Preclinical and Clinical Requirements for Oral Contraceptives in the United States

Phase I:	Ninety-day studies in rats, dogs, and monkeys must be completed prior to Phase I studies, which involve 10-20 individuals for up to 10 days. (For other drugs, Phase I studies can be initiated after 2-4 week studies in two animal species.)
Phase II:	One-year studies in rats, dogs, and monkeys must be completed prior to Phase II studies, which involve approximately 50 women for three menstrual cycles. (For other drugs, Phase II studies can be initiated after 90-day studies in two animal species.)
Phase III:	Two-year studies in rats, dogs, and monkeys must be completed and 7-year dog and 10-year monkey studies must be initiated before Phase III testing may begin.
Marketing approval:	Progress reports on long-term studies in dogs and monkeys are required at the time of new drug application (NDA) submission. (For other drugs, chronic toxicity studies—including 1-year dog, 18-month mouse, and 2-year rat studies—must be completed by the time of NDA submission.)

SOURCES: M. Finkel: "Contraceptive Regulation in the U.S.," paper presented at the PIACT Workshop on Developing Countries and the Regulation of Contraceptive Drugs and Devices, Seattle, Wash., July 24, 1978; E. I. Goldenthal, "Current Views on Safety Evaluation of Drugs," *FDA Papers*, May 1968, pp. 13-18; E. I. Goldenthal, "Contraceptives, Estrogens, and Progestogens: A New FDA Policy on Animal Studies," *FDA Papers*, November 1969, p. 15.

dog and 10-year monkey studies v. 1-year dog, 18-month mouse, and 2-year rat studies before an NDA can be submitted.

FDA regulations also require that the beagle be the breed of dog used to test oral contraceptives for safety. This requirement has raised the most controversy, because the appearance of breast tumors in beagles when given depot medroxyprogesterone acetate (Depo-Provera) was one of the reasons why the FDA denied Upjohn Co.'s supplemental NDA in 1978.

The reasons given for FDA's nonapproval included more than the appearance of breast tumors in beagle dogs. The complete list of reasons was:

- malignant breast tumors in beagle dogs;
- estrogen may be administered to women receiving Depo-Provera in order to control the irregular bleeding disturbances often caused by this drug. In FDA's opinion, the added risk of cancer from the simultaneous use limited the benefits that might be associated with a progestin-only contraceptive;
- the patient population originally targeted for Depo-Provera had diminished substantially as other methods of contraception and sterilization became increasingly available and accepted;
- doubts that the proposed postmarketing studies on breast and cervical carcinomas would yield meaningful data; and
- progestin and estrogen-progestin drugs increase the risk of congenital abnormalities in the fetus. Depo-Provera is a progestin, and a failure of contraception or an error made by injecting a woman already pregnant would result in exposure of the fetus to this hormone (9).

Depo-Provera is currently approved for use in the United States only for inoperable cancer of the uterus and renal cancer, a use approved since 1972. It is manufactured and used as an injectable contraceptive in other countries. Drugs produced abroad for use abroad are beyond FDA's regulatory reach.

Contraceptive drugs are given to young, healthy individuals and can potentially be administered over a period of 30 years. FDA requires testing in both the beagle and the monkey because the beagle is highly susceptible to spontaneous breast tumors, the monkey is relatively resistant, and the human female falls between the beagle and the monkey in the incidence of spontaneous breast tumors. FDA also points out that no contraceptive currently approved for marketing has shown a carcinogenic potential in the beagle dog assay similar to Depo-Provera (14).

In contrast, other internationally recognized agencies have taken the position that the beagle dog is not predictive of any risk of breast cancer in women using steroid hormones. These agencies include the Special Programme of Research, Development, and Research Training in Human Reproduction of WHO (October 1978); the Committee on the Safety of Medicines in the United Kingdom (February 1979); and the International Planned Parenthood Federation (IPPF) (November 1980). In addition, a recent review of Depo-Provera concluded that "a great deal of human data have been collected and these show no evidence of human risk at present" (7).

The Depo-Provera issue has focused much attention on the beagle dog, but this specific controversy should be viewed in its broader context. Safety testing for contraceptives is understandably more stringent than for other drugs in both the length of testing required and in the kinds of laboratory animals subjected to testing. Both requirements increase the time and expense incurred in contraceptive product development compared with product development for drugs in general.

EXPORT OF DRUGS AND MEDICAL DEVICES

A large, expanding market for contraceptives no longer exists in the United States but does in the LDCs, where large percentages of people are either in their reproductive years or about to enter them.

In general, the U.S. Food, Drug, and Cosmetic Act prohibits U.S. pharmaceutical manufacturers from exporting drugs not approved for marketing in the United States. Two categories of drugs are at issue: 1) drugs unevaluated for use; and 2) drugs evaluated but found unacceptable for use. A few exceptions to this provision exist; e.g., investigational drugs can be exported for investigational purposes, provided that an importing country's government has approved such imports.

Medical devices that are not approved for marketing in the United States can be exported, provided: 1) they conform to the laws and specifications of the importing country; and 2) their export is not considered by the Secretary of Health and Human Services to be contrary to the public health and safety of the importing country.

Changes in the export provision of non-FDA approved drugs have been considered by Congress. In the 96th Congress, a bill adopting the medical devices export law for drugs passed the Senate but died in the House of Representatives.

The U.S. Government's policy of prohibiting the export of non-FDA approved drugs is based on safety and efficacy concerns. FDA recognizes that different standards may exist elsewhere but does not know which ones to apply when U.S. standards are not met. Some importing countries also do not have mechanisms to either evaluate or regulate the quality of drugs they import (18), so the United States is unable to defer to or apply these standards. There are also documented episodes of "drug dumping;" i.e., situations in which drug companies promote products in LDCs deemed unsafe or ineffective in more developed countries (MDCs). The analgesic drug Dipyrone, for example, was removed from the U.S. market because of its documented toxicity, yet it is marketed over-the-counter in several Central and South American countries (4). In addition, substantial differences in product labeling—e.g., indications for use and precautions—have been noted for selected products marketed in different countries (15), but attempts to develop international uniform labeling standards have been only partially successful.

Those who advocate exportation of drugs unapproved in the United States base their arguments on the right of a country to make its own risk/benefit analyses, differing risk/benefit ratios in other countries, and economic concerns.

The belief that an importing country has a right to assess the risk/benefit ratio for a drug's use among its people is consistent with the international legal principle of comity, which states that countries have a duty to respect the sovereign rights of other nations. Further, because of international variations in life expectancy, standards of living, prevalence of diseases, and availability of health care, the relative risks and benefits of a given drug are different among different populations.

In order to market products unapproved in the United States, several American pharmaceutical companies have either established, purchased, or used manufacturing facilities in foreign countries, where their products are either approved for use or where laws permit the export of unapproved products. Some U.S. manufacturers argue that if they were able to export their nonapproved products from the United States, they would manufacture such products in this country rather than abroad. They further argue that such manufacturing would contribute to the U.S. economy (in terms of capital formation and employment) and thus help improve the United States' international balance of payments.

The Depo-Provera controversy has also contributed to this debate over current law on the exportation of drugs not approved for use in the United States. Because it is approved for U.S. use for the treatment of endometrial and renal cancer but not for use as a contraceptive, Depo-Provera manufactured in the United States cannot be exported as a contraceptive. But it is manufactured abroad, and in 1977 was in use in 42 countries (13).

AID has received requests from LDCs for financial assistance to purchase Depo-Provera for contraceptive purposes. But AID's usual position has been to refrain from providing other countries with drugs not approved by the FDA for use in the United States. A panel of external advisors to AID recommended in 1980 that the agency make Depo-Provera available to those nations that request it for contraceptive use, despite FDA's nonapproval (17). In October 1981, FDA had chosen the members of a Public Board of Inquiry to evaluate the findings on Depo-Provera; AID is awaiting the Board's recommendations. However, AID does help finance UNFPA and IPPF, both of which purchase Depo-Provera. Because UNFPA commingles its funds, money from a particular donor cannot be earmarked for specific uses. IPPF, however, itemizes its expenditures by donor so that AID is assured that its funds are not used for purchasing Depo-Provera.

Here again, as with the case of the beagle dog findings for Depo-Provera's carcinogenic potential, the specific controversy surrounding the ban on export of U.S.-manufactured Depo-Provera for contraceptive use should be viewed in its broader context. That is, it should be taken as illustrating, and not controlling, the difficult issues surrounding current U.S. policy on the exportation of U.S.-manufactured drugs.

Patent life

Drug patents run for 17 years, but the industry has expressed concern that the FDA market approval process takes so long—an average of 7½ years—that effective patent life is shortened and too little time is left for them to recoup their investments (6). Patent life could be legislatively extended beyond the current 17-year limit, or effective patent life could be lengthened if the FDA approval process were shortened. How significantly does the shortening of effective patent life diminish incentives to research and develop new contraceptives?

The first company that puts a product on the market has the advantage of capturing a larger proportion of potential users than a company entering the market later. Its initial investment is also greater, since it must underwrite the research costs. Once its patent runs out, if other companies then enter the market and manage to cut into its sales, its return on investment is diminished.

In the field of oral contraceptives, Wyeth Laboratories and Ortho Pharmaceutical share approximately 70 to 80 percent of the market in the United States. Wyeth's patent on norgestrel is still in effect, but the patent on norethindrone (the progestin in the products marketed by Ortho, Syntex, Parke-Davis, and Mead-Johnson) expired in 1973. After the expiration of the patent on norethindrone, only Mead-Johnson and Lederle entered the market with oral contraceptives. Even though competitive pricing was utilized by these companies, they did not capture a substantial share of the market, and Lederle subsequently withdrew. No generic pharmaceutical house has entered the market.

The Pharmaceutical Manufacturers Association (PMA) reported in August 1980 that of all classes of pharmaceuticals, oral contraceptives experienced the greatest increases in price for the reporting periods 1969-79 (187 percent) and 1978-79 (23.7 percent). In contrast, for over 1,000 ethical drugs, PMA reports only a 37.4-percent average increase in price for the period 1969-79 and a 6.5-percent increase for 1978-79. Attractive profits would be expected from such price increases and would be expected to lead to price competition or the entry of new competitors. But these price increases occurred primarily after the patents on norethindrone and norethynodrel (Searle's progestin) had expired and during Mead-Johnson's and Lederle's entries into the oral contraceptive market.

PMA estimates that between 8 and 9 million women in the United States now use oral contraceptives, and a substantial number of women (between 500,000 and 1 million) currently initiate use of oral contraceptives each year. But because the U.S. birth rate is close to replacement level, the U.S. market is relatively static as new users of oral contraceptives replace those aging beyond the reproductive years and those who discontinue use for other reasons. Thus, pharmaceutical companies that seek to market generic versions of brand name contraceptives after patents expire must compete in a limited market, with high advertising costs the probable entry price.

Oral contraceptives have also had difficult product liability problems. These contribute to uncertainties in business profit/loss projections and project a negative image that may affect the public's confidence in a pharmaceutical company's other products as well as in its contraceptive products. The ability of the original oral contraceptive manufacturers to retain their market share and raise prices significantly despite expired patents may not be completely explained by a limited U.S. market and the negative image that may be keeping other pharmaceutical companies out of the field. However, this ability to keep the market captive in the face of patent expiration and rising prices does lead to the conclusion that, at least for the oral contraceptive market, initial entry into the market seems to be the determining factor, not the length of patent life as affected by the FDA market approval process.

Product liability

Product liability, its costs to business, and possible inhibition of new product development have been prominent issues in recent years. While not limited to the pharmaceutical and medical devices industries, its most visible impacts have been through the national swine flu immunization program of 1976 and in lawsuits involving the hormone diethylstilbestrol (DES), oral contraceptives, and intrauterine devices (IUDs).

Product liability problems, and the ability of manufacturers to pass on their insurance and litigation costs to purchasers, may affect the kinds of future contraceptives developed. Products that involve a single sale or limited repurchase, such as IUDs, provide little means to adjust for increasing liability exposure once the device is sold. Oral contraceptives, on the other hand, require periodic purchases. A. H. Robins ceased selling its Dalkon Shield IUD in 1974, and in 1980 some of the devices were still in place, so some users maintained the device in place for at least 6 years. An oral contraceptive would have required repeated purchases during that period of time, and the price of the monthly dose package could have been adjusted to reflect changing product liability risks. Or if the sale of the contraceptive had been terminated, existing supplies of the contraceptive would have been disposed of or consumed.

Although oral contraceptives represent only about 4 percent of the total ethical pharmaceutical market, more suits are filed on oral contraceptives per year than on any other class of ethical pharmaceutical products. Several manufacturers of oral contraceptives reported to OTA that they have more product liability claims for contraceptives than for all of their other pharmaceutical products combined.

Injuries from these causes do not usually result from negligence in their manufacture, distribution, or administration, but rather are statistically rare injuries that will inevitably occur in a few people. In legal parlance, these are "unavoidably dangerous" though socially useful products, and the U.S. courts have developed many legal doctrines as possible avenues through which the injured person might obtain compensation for the injuries suffered. That is, rather than leaving the economic burden of the injury on the injured persons, courts have tried to shift the economic loss to the "deep pockets" of the product manufacturers; for example, by imposing a "duty to warn" of serious side effects on the manufacturer and developing a test of whether the product user had given his/her "informed consent" to use the product after being warned of the possible side effects that could occur with use. But legally adequate "duty to warn" and "informed consent" do not avoid injury. Successfully meeting both tests simply means that the already injured plaintiff will fail in the lawsuit.

Product liability is part of business costs for manufacturers and has traditionally been covered by insurance. Expansion of product liability has led to uncertainties in pricing such insurance, which in turn has led insurance companies to treat such products as special risks or to move out of the market, leaving manufacturers to self-insure such losses by pooling funds among several manufacturers or by establishing "captive" insurance companies. These product liability and insurance problems have been examined in a previous OTA report, "A Review of Selected Federal Vaccine and Immunization Policies" (11). One result of that report was a request by Congress to enumerate the elements that would constitute a Federal compensation program for injuries caused by vaccines. That report, "Compensation for Vaccine-Related Injuries," was released in November 1980.

Does product liability have an inhibitory effect on the propensity of the pharmaceutical industry to research and develop new contraceptives, to continue to produce proven contraceptives, and to enter established markets after the developer's patent has expired? These are difficult questions to answer for the contraceptive products field in isolation from what is happening in product liability in general (e.g., football helmet manufacturers) and in liability per se (e.g., professional malpractice, whether in medicine, law, engineering, the clergy, etc.), but the evidence does point to an inhibitory effect. Whether product liability does or will fundamentally affect the contraceptive field is speculative, but the following findings indicate that it is a significant problem.

Product liability and the adverse publicity that attaches to a specific product can affect contraceptive development and use in two ways. First, product liability affects the predictability of business expenses and what profit margins can be expected. If these costs are predictable, the product's price can be adjusted. If not, the manufacturer cannot limit its exposure except by taking the product off the market. In addition, however, such costs may become so large that they affect the price to the extent that demand may be depressed. And adverse publicity about a specific contraceptive may: 1) turn consumers to other contraceptives (which would be justified if the information is correct; i.e., market forces and "informed consent" would be working appropriately); and 2) affect the manufacturer's decision on what kinds of contraceptives to develop and continue to sell (e.g., oral v. injectable contraceptives, IUDs v. oral contraceptives).

Predictability and the spreading of costs are fundamental insurance tenets. But two developments have affected their stability in recent years. Lawsuits are usually filed and contested in State courts, whose supreme courts develop and follow their own legal doctrines. However, a State's supreme court may adopt the doctrine of another State, and it is difficult to predict when and if this will happen.

Recently, the California Supreme Court (16) decided that an injured party who does not know which manufacturer made the product that led to the injury can sue any of those who act in "conscious parallelism" and who may have produced the drug used by the patient. The plaintiff had developed cancer alleged to be caused by the hormone DES, taken by her mother 26 years earlier to prevent a miscarriage. No evidence existed as to which of the defendant companies manufactured the DES used by the mother. More than 200 companies manufactured DES at that time. Michigan has reached a similar result but on different legal reasons (1).

The variance in damages for a successful lawsuit may literally be millions of dollars. Spokespersons for manufacturers of oral contraceptives estimate that most jury verdicts for death or severe injury range from $100,000 to $4 million, and a suit involving its Dalkon Shield IUD resulted in a $6.2 million verdict against A. H. Robins.

In addition to judgment costs, there are administrative costs of handling claims, the great majority of which never reach the courtroom stage. For instance, A. H. Robins marketed its Dalkon Shield IUD from 1970 to 1974 and sold approximately 2 million. According to Robins, the first reports of problems (septic abortions) occurred in late 1973. As of September 30, 1980, there had been 4,660 claims filed against Robins, with 1,482 pending and 3,178 closed. Total settlements and judgments paid were $69 million, and Robins estimates its legal fees and expenses to be about $20 million, or a total of about $45 (and still growing) for each IUD sold. Robins was receiving 100 claims per month at the end of 1980. Robins' insurer increased premiums and deductibles for IUD coverage to the extent that Robins rejected the policy in 1978. Robins found that its loss record on the Dalkon Shield prejudiced its ability to obtain coverage on other pharmaceutical products. In order to obtain product liability insurance on other pharmaceutical products, Robins had to pay a $1.4 million surcharge (8).

These escalations in the scope of liability costs have had two effects: raising the price of contraceptives that have remained on the market, and leading insurers to treat contraceptives as special risks. For example, one oral contraceptive manufacturer estimated that product liability expenses for a 20- to 30-percent share of the market have totaled about $15 million for the past 10 years and have been escalating at about $3 million to $4 million per year. Another oral contraceptive manufacturer estimates that 10 percent of its sale price is earmarked for product liability claims (10).

As for contraceptives as special risks, standard product liability policies for pharmaceuticals now specifically exclude only four types of products—swine flu vaccines, DES, oral contraceptives, and IUDs. Also, insurance usually comes in a trifurcated form—a deductible, the standard policy, and excess insurance—and these components have changed. For example, the deductible may have been several hundred thousand dollars, the basic policy for the next $5 million to $15 million, and the excess insurance up to a specific limit; e.g., $25 million to $30 million. This excess insurance would be provided at a separate premium, either through a pool of several insurance companies to spread the risk, or through a high-risk insurer such as Lloyd's of London. Today, the self-insurance requirement may be up to $5 million, the premium itself for the standard policy in the millions, and the excess insurance either not available or with a premium in the million-dollar range.

Organizations supporting R&D of contraceptive products are not immune to liability. For instance, the Ford Foundation and the Population Council both carry liability insurance. Even though such organizations may not manufacture or sell contraceptives in the United States, the fact that a contraceptive product that causes harm was developed under their support could subject them to liability.

The developer of a new contraceptive product also bears the risk of liability during clinical trials. The standards for liability are in general more varied with respect to clinical trials and often the doctrine of product liability does not apply. Uncertainties nevertheless exist. While many developers of pharmaceuticals and medical devices have asserted in an OTA telephone survey that they have had no liability problems in clinical trials, there have been reports of difficulties for contractors and developers in obtaining affordable and meaningful insurance.

Liability problems arise when the research is sponsored at institutions that do not belong to the pharmaceutical industry (3). The cost of liability insurance is included in contracts when necessary, but it is expensive and difficult to obtain. WHO has reported difficulty in securing contractors for clinical trials because insurance was not available to the contractor. In at least one instance, a potential NIH contractor could not procure adequate liability insurance for a phase I clinical trial. In another NIH-funded phase I clinical trial, the insurance for a 1-month, 12-woman study was in the neighborhood of $30,000, and the policy required considerable amounts of time and effort to procure.

There are clear indications that current product liability in the contraceptive field is more severe than for other classes of products, has raised costs, and is severe enough in cost escalation and unpredictability to have affected the insurance companies' way of doing business with pharmaceutical manufacturers. This situation is conducive to diminished interest in future contraceptive research by profitmaking companies. In addition, liability insurance in the clinical trial phase of development has become expensive and sometimes hard to obtain, thereby adding to developmental costs and, because of difficulty in purchasing such insurance, imposing another impediment to the developmental process.

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Chapter 7

Factors That Affect the Distribution, Acceptance, and Use of Family Planning in LDCs

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Chapter 7

Factors That Affect the Distribution, Acceptance, and Use of Family Planning in LDCs

Abstract

The factors that influence people to plan their families act at all levels of society. The process of choice by families and individuals is interactive, complex, and only partially understood. Because individual perceptions determine whether to use a method of fertility planning and which method to use, individual needs must be taken into account in population program design. Most contraceptives are used by women, but male attitudes toward contraception are extremely important. A woman's status, age, and present number of children interact with many other factors to influence her decision to adopt and continue to use family planning methods. One index of latent demand for family planning services in less developed countries (LDCs) is seen in World Fertility Survey (WFS) data that show that from 12 to 47 percent of married fecund women in countries surveyed want no more children, yet only a fraction of these women are now using family planning methods. Many constraints to contraceptive use are attributes of contraceptives themselves. The four most important attributes to women are effectiveness, absence of side effects and convenience, route of administration, and frequency of use. Because many contraceptives change menstrual patterns, women's perceptions of menstruation can hinder—or sometimes enhance—the acceptability of a particular method. In clinic settings, location and hours of operation, degree of privacy, kind of information and how given, and availability of preferred methods are important considerations. Specific contraceptive intentions, social support, perceived accessibility of services, between-spouse communication, and desire for additional children are the most important predictors of contraceptive behavior in some LDCs.

Marital and childrearing expectations and experiences of men and women tend to differ greatly; the extent to which women share in decisionmaking has a significant impact on family planning decisions. Preference for sons is consistent across all countries; girls have higher mortality rates in many countries and wives are often not respected until they bear sons. This preference is unlikely to change until women's status improves. Women's clubs and other female voluntary organizations in LDCs are now giving women heretofore unavailable economic and family planning opportunities, and the traditional roles of midwives are being expanded to include family planning services delivery.

The factors present in a particular country when fertility begins to decline usually include: 1) governmental policies that encourage equal status and opportunities for women, higher age at marriage, more equitable distribution of wealth and educational opportunities, all of which lead to a higher standard of living; 2) programs designed to bring about a decline in infant mortality; 3) a government policy with explicit goals for reduction of birth or population growth rates; 4) a strong commitment to population planning by the country's leaders; 5) a family planning organizational structure with executive power to mobilize more than one government sector and to coordinate with the private sector; 6) population program funding (usually both external and internal sources); 7) provision of a broad range of contraceptive methods; 8) sufficiently trained and motivated family planning program personnel; 9) population and family planning information

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and communication efforts that effectively reach all sectors of the populace; and 10) direct or indirect incentives that encourage couples to limit the size of their families. Governmental perceptions of population growth rates differ greatly; most allow access to contraception as a health measure and human right; many actively encourage family planning; others take no direct role. Thirteen of the fifteen most populous LDCs consider their fertility rates too high. There are clear differences in outcome between policies with demographic objectives and those aimed primarily at improving health care; about two-thirds of those with policies to reduce population growth have either strong or moderate programs and show greater declines in birth rates after allowing for the effect of level of socioeconomic development. Only a relatively more developed socioeconomic setting can overcome a weaker policy position in its effect on fertility decline.

A committed political elite and active private sector are important to developing population awareness and in providing services; programs that include both public and private efforts are most effective. Up-to-date demographic and program evaluation data are crucial to program and policy actions, as are information, education, and communication (IEC) programs. Integration of family planning with other development activities has often been carried out by placing family planning programs within health ministries in maternal and child health programs, but requires specific allocations of personnel and facilities to avoid becoming a second order priority where health needs are acute. The impact of newly introduced incentive schemes to increase family planning use—free education, payments for sterilization, etc.—has not yet been fully evaluated. These schemes have engendered controversy less because of inherent discrimination than because of the ways in which they have been implemented; careful planning is necessary to avoid compromising individual choice. A frequently overlooked aspect of coercion is the social coercion to bear more children than are wanted.

Commercial retail sales and community-based distribution systems have been effective in raising awareness of family planning, making contraceptives available in rural and urban areas, and putting family planning programs on the road to becoming self-financing. A limited number of methods are available, but referral services are usually provided. Governmental decisions about methods provided are crucial because each method carries with it unique logistical requirements, cultural considerations, import-export regulations, safety characteristics, and restrictions on provisions and use. Because many governments are building local production capacity through foreign exchange controls, and most new technologies are likely to be developed in more developed countries (MDCs), access to new technologies by LDCs could be limited. This could prove detrimental because family planning programs tend to be more successful if their range of methods can meet current needs of users and allow users to adopt other methods as their needs change. Although there are some exceptions, family planning programs make a difference in reducing fertility. Countries whose levels of economic development are relatively high show greater declines than poorer countries, but, on balance, family planning programs have a significant independent effect. Weak programs have little or no effect. On average, 60 to 65 percent of the fertility declines from 1965-75 are attributable to the level of socioeconomic development; about 15 to 20 percent to family planning program efforts; about 5 to 10 percent each to the population's age structure, and actions to raise age at marriage; and about 15 to 25 percent to unknown or unmeasured factors. Programmatic requirements for the 495 million couples (excluding China) who will need contraception in the year 2000 will be prodigious. Seven aspects of technical assistance/programmatic support are particularly important: allocating resources, establishing cost effective, self-supporting programs, expanding availability of services to reach rural populations, integrating family planning with other components of development, strengthening program management, increasing opportunities for women and raising their status, and effectively using present and new technologies.

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Points of intervention and choice

The adoption of family planning can have a direct and important impact on the reduction of population growth. LDC government leaders, aware of the potential benefits of family planning programs and faced with the prospect of the doubling of many of their populations over the next 25 years, are giving greater attention to the status of family planning in their countries. The findings are often contradictory:

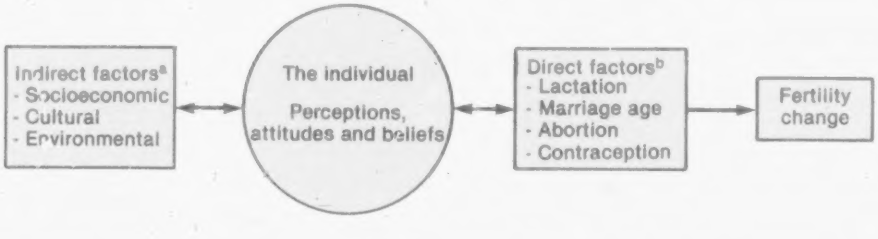
- An average of 50 percent of married women in LDCs report that they want no more children, yet from 25 to 90 percent of these women do not now practice contraception. (Asian and Latin American estimates; data from Africa are not yet available.)
- Variations in contraceptive use are enormous. Contraceptive prevalence rates range as high as 70 percent and as low as 2 percent of currently married women in LDCs.
- Many women in LDCs report having from one to as many as three more children than they wanted. The policy implications of this acknowledged unwanted fertility—of children already born—are important in that resulting fertility rates are one-third to one-fourth higher than these women desire.

Most women are fecund (capable of bearing children) from age 15 to about age 45 and most men are able to sire children throughout adult life. The decision to have a child, or to use a contraceptive, is influenced by both past and present conditions. Recent research centers on the four factors that have the greatest direct impact on fertility (see ch. 4):

- age at marriage and proportion married;
- lactation (breastfeeding);
- induced abortion; and
- contraceptive use.

Efforts to change fertility rates by changing the relative influence of these factors, which are in turn influenced by such indirect determinants as community attitudes about contraception, levels of education, income, and family relationships (fig. 22) can have unanticipated results. The socioeconomic determinants affect fertility in ways that are only partially understood. Nevertheless, their influence is extremely important. For example, fertility has declined at a more rapid rate in Colombia, Thailand, and South Korea, which have relatively high socioeconomic settings, than it has in the lower income countries of Bangladesh, Pakistan, and Kenya, but the relatively low-income country of

Figure 22.—The Pattern of Influence of Direct and Indirect Factors on Fertility



NOTE: Interactive relationships are symbolized by double headed arrows; direct relationships by single headed arrow.

[a] Includes: husband-wife communication, accessibility of services, influence of friends and family, level of education, place of residence, knowledge of family planning and methods of contraception, religious taboos, family income, economic level of of the country, etc.

[b] Also termed "proximate" or "intermediate."

SOURCE: Office of Technology Assessment.

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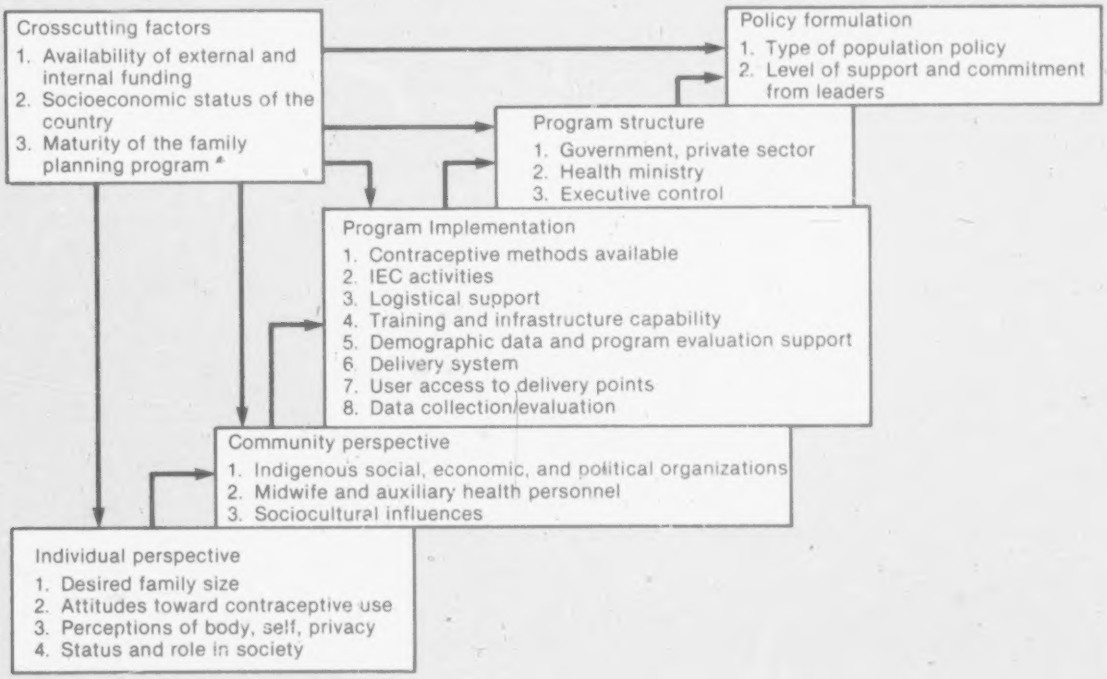
Indonesia (Java and Bali) has also experienced rapid fertility decline.

Because contraceptive use has become increasingly important in reducing fertility, family planning programs focus on this intervention. Yet policies and programs that are multifaceted—that simultaneously take account of both the other primary factors and the indirect influences listed in figure 22—are the most likely to be successful. This chapter examines the results of directed or undirected changes in the four direct factors listed above.

At least five separate levels of interaction can be distinguished. Each is a point of both intervention and choice. At each point choices are available and decisions must be made (fig. 23). At the government level, a point of intervention/choice is the formation of population policy. The type of policy and the rationale and support for that policy influence the country's population growth rate. A second crucial point of intervention/choice is the determination of the structure, form, and function of a family planning program. Some governments choose to keep programs and their implementation entirely under official control; others choose to keep programs exclusively in the private sector; still others choose a combined approach. A third point of intervention/choice is the selection of delivery system or systems used to implement the program. These systems include IEC efforts. Intervention and choice also operate at the community level. Social structure, culture, personal networks, and voluntary groups all come into play, but the most important decision is that of the individual, who chooses whether to adopt family planning. All governmental or orga-

Figure 23.—Selected Points of Intervention and Choice

Each link in the chain of interactions provides options. Decisions must be made by individuals, groups, and governments as to which options are appropriate and feasible.


Crosscutting factors
1. Availability of external and internal funding
2. Socioeconomic status of the country
3. Maturity of the family planning program
Policy formulation
1. Type of population policy
2. Level of support and commitment from leaders
Program structure
1. Government, private sector
2. Health ministry
3. Executive control
Program Implementation
1. Contraceptive methods available
2. IEC activities
3. Logistical support
4. Training and infrastructure capability
5. Demographic data and program evaluation support
6. Delivery system
7. User access to delivery points
8. Data collection/evaluation
Community perspective
1. Indigenous social, economic, and political organizations
2. Midwife and auxiliary health personnel
3. Sociocultural influences
Individual perspective
1. Desired family size
2. Attitudes toward contraceptive use
3. Perceptions of body, self, privacy
4. Status and role in society

SOURCE: Office of Technology Assessment.

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nizational interventions can be effective only to the degree that they affect individual behavior.

Crosscutting all of these levels of intervention are the country's overall level of development, which in large measure determines the ability to implement and administer a program, and its ability to fund the program.

Fertility change is an interactive, dynamic process in which individuals, groups, and governments seek to modify the attitudes, customs, and behavior that surround the most personal, intimate part of human life. Awareness of the individual and social factors impinging on this process can help to avoid the mistaken view of modern contraceptive methods as "technological fixes" that can, by themselves, lower fertility rates. One of the most important and encouraging findings of recent years is that family planning attitudes and behavior can change rapidly. Population programs thus need to be designed to take account of individual rights and cultural values while educating individuals and helping them to change. This chapter highlights the complexity of this process.

Individual concerns: the user perspective

> When I think of all the things I ate or swallowed, hoping that they would prevent me from having another child! But they didn't work. Now it is better because I have an IUD. (A village woman, Mexico) (10)

The perceptions of the individual—based on the degree of benefit expected from contraceptive use, and the expected duration of that benefit—determine whether he or she will use a fertility planning method. Because individual fertility behavior is both the impetus for and the target of family planning systems, individual needs must be respected and incorporated into these systems.

Although a significant proportion of males use condoms and some elect to be sterilized, most contraceptives are used by women and this situation is unlikely to change greatly in the near future. This section is thus devoted to the individual woman's perspective. (See *Community Concerns* for a discussion of what is known about male attitudes toward family planning and use of contraception.)

The myriad influences on a woman's decision to adopt family planning include not only the attitudes of her husband, family, and social networks but also the availability and cost of methods. Moreover, the impact of various factors is different depending on her status, age, and the number of children she already has. Once she decides to use a method, her perceptions and attitudes influence her choice. (See table 29 for categories of influences.) For example, a woman might perceive the side effects (irregular menstrual patterns) of a contraceptive injection as intolerable over a long period. Yet she might find them tolerable when she and her husband have agreed that she will be sterilized but she must wait 6 months until a sterilization team visits the village.

Table 29.—Types of Influences That Pertain to the Acceptance and Continued Use of Contraceptive Methods

Individual user criteria for acceptability	Attributes of methods	Lifecycle stage considerations
Personal, motivational	Gender of user	Premarital
Cultural	Mode of action	Delay first birth
Religious	Organs/systems involved	Spacing of births
Sexual, libido	Route of administration	Completion of fertility
Supply requirements	Frequency of use	
Economic	Circumstances of use	
Political	Effectiveness	
Philosophical	Duration of effect	
Convenience	Side effects	
Available medical support for treating side effects	Safety	
	Cost	
	Delivery requirements	

NOTE: Influences overlap; many are acceptability criteria as well as attributes of methods.

SOURCE: S. Polgar and J. Marshall, "The Search for Culturally Acceptable Fertiltiy Regulating Methods," in Marshall and Polgar, (ed) *Culture, Natality and Family Planning*, Population Center, University of North Carolina Monograph 21, 1976, Chapel Hill, N.C., R. Freedman and B. Berelson, "The Record of Family Planning Programs," *Studies in Family Planning 7*, No 1, Jan 1976, The Population Council New York. R. Greep, M. Koblinsky, and F. Jaffe, *Reproduction and Human Welfare: A Challenge to Research*, Ford Foundation, MIT Press, Cambridge, Mass., 1976.

Latent demand for family planning

WFS data provide good evidence of the latent demand for contraception in their measurement of the percentage of women who want no more children yet use no contraception. Although this measure may be inflated because some women who want no more children would not use contraception even if readily available because of pressures from peer group, family, or spouse, it does provide a useful estimate of unmet demand for family planning services.

The proportion of "exposed" women (those currently married, nonpregnant, and fecund—capable of childbearing) who want no more children varies from a low of 17 percent in Kenya to a high of 74 percent in Korea (table 30). The estimates of unmet demand are contained in column 2 in table 30; they range from a high of 47 percent in Bangladesh and more than 30 percent in Korea, Sri Lanka, and Peru to a low of 12 percent in Costa Rica.

Table 30.—Percentage of Exposed[a] Women Who Want No More Children, Percentage Not Currently Using Contraception, and Estimates of Unmet Need for Effective Contraceptive in 15 LDCs

	Of exposed women, percent who want no more children	Of all currently married women, percent who are exposed and want no more and are not using	
		Any method	Modern method
Asia and Pacific			
Bangladesh[b]	64	45	47
Indonesia	40	13	15
South Korea	74	25	32
Malaysia	46	17	22
Nepal	30	21	21
Pakistan	42	26	27
Sri Lanka	62	22	31
Thailand	61	20	22
Latin America			
Colombia	61	22	30
Costa Rica	52	7	12
Dominican Republic	52	17	23
Mexico	56	21	26
Panama	63	14	19
Peru	61	25	38
Africa			
Kenya	17	NA	NA

[a] All currently married, nonpregnant, and fecund women, including those sterilized for contraceptive purposes.

[b] Bangladesh only—Some women were asked: "Do you want another child soon?"

SOURCE: M. Kendall, "The World Fertility Survey: Current Status and Findings," *Population Reports*, series M, no. 3, July 1979, Population Information Program, Johns Hopkins University, Baltimore, MD.

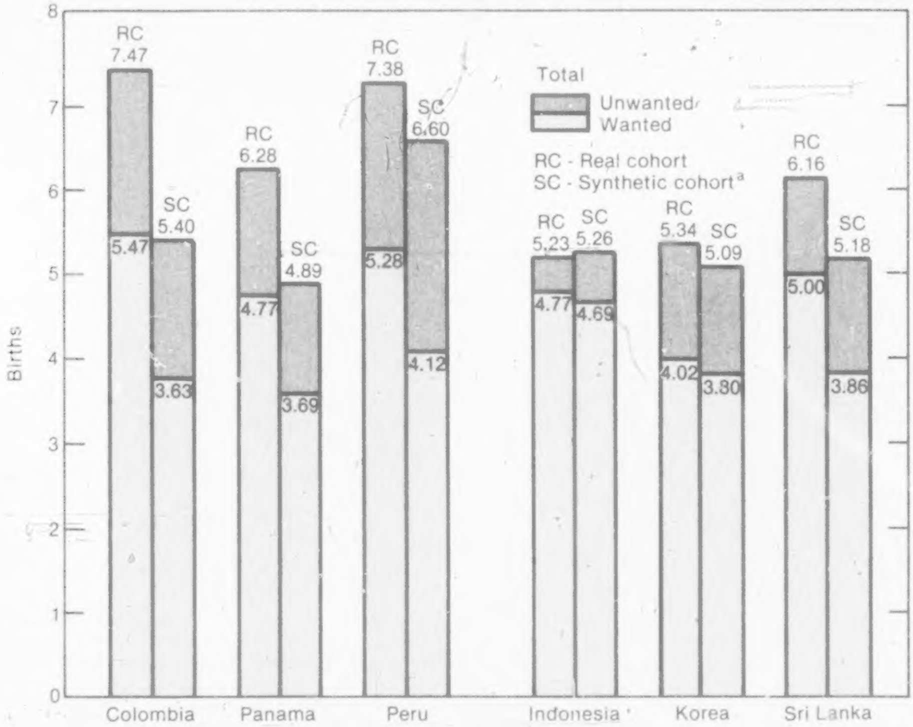
Rates of contraceptive knowledge—knowledge of at least one modern family planning method—are high in these countries, with the exception of Nepal, where only 21 percent of women know of a modern method. Rates in Bangladesh and Indonesia (81 percent), Kenya (88 percent), and Pakistan (71 percent) fall into the middle range, but in all other countries for which data are available, 90 to 100 percent of women know of modern contraceptive methods (15).

Women in countries where WFS surveys were conducted were also asked if their most recent pregnancy was desired. Although their answers provide a conservative estimate of unwanted fertility because many women are likely to rationalize a child as wanted after it is born, the levels of admitted unwanted fertility are striking (fig. 24). For example, when women in Peru and Colombia complete their childbearing, they have an average of 2.75 and 2.19, respectively, more children than they wished to have (table 31). In national terms, the percentage of unwanted births constitutes about a third of all births in Peru and Colombia and a quarter of those in Panama and Sri Lanka. The lowest rates of unwanted fertility are observed in Indonesia and Korea. In Korea, high rates of induced abortion make unwanted fertility rates correspondingly low (50).

Cultural values and the adoption of family planning

Why do large numbers of women admit to wanting no more children or to having more children than they wanted, yet use no contraception despite high levels of knowledge of contraception? Among the many possible constraints to contraceptive use—lack of supplies, fear of side effects, antipathy of the husband—personal attitudes and customs appear to play a major role. Individual cultural traditions, sexual taboos, and attitudes toward menstruation, sexuality, childbearing, and "proper" sex role behavior can strongly influence the ac-

Figure 24.—Levels of Unwanted Fertility in Selected LDCs



[a]When lifetime data for an age group are unavailable, age groups representing a cross section of the population at a given point in time are substituted. (see *cohort* in Glossary.)

SOURCE: C. W. Westoff, "Unwanted Fertility in Six Developing Countries," paper presented at World Fertility Conference, London, 1980.

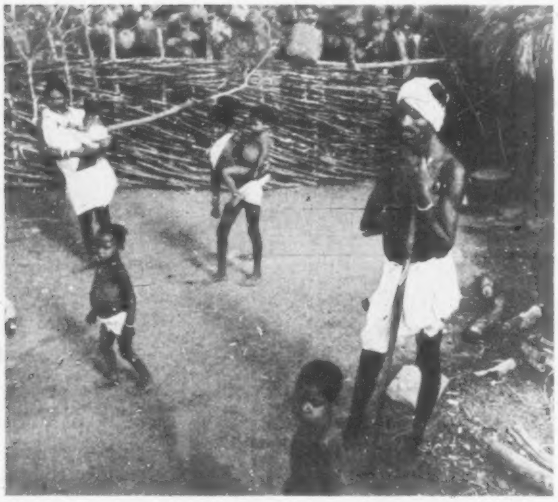


Photo credit: Agency for International Development

Village family in a remote sector of Madhya Pradesh, India

Table 31.—Probability of Ever Having an Unwanted Birth and the Cumulative Unwanted Fertility Rate per Woman by Interval (Years) Since the Last Wanted Birth

Years since last wanted birth	Colombia	Panama	Peru	Indonesia	South Korea	Sri Lanka
	Cumulative unwanted fertility rate					
1	0.03	0.04	0.05	0.01	0.01	0.02
2	0.31	0.20	0.30	0.07	0.09	0.17
3	0.55	0.39	0.60	0.21	0.31	0.37
4	0.73	0.52	0.82	0.32	0.43	0.52
5	0.89	0.64	1.04	0.39	0.53	0.62
10	1.48	1.06	1.82	0.59	0.91	0.98
15	1.93	1.33	2.41	0.72	1.06	1.16
20	2.19	[illegible]55	2.75	0.76	1.12	1.26

SOURCE: C. W. Westoff, "Unwanted Fertility in Six Developing Countries," paper presented at World Fertility Conference, London, 1980.

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ceptance and continued use of contraceptive methods.

Women in the Philippines, Korea, Indonesia, and Mexico rated the four most important attributes of a contraceptive as: 1) effectiveness; 2) absence of side effects and convenience; 3) route of administration (oral, injectable, or vaginal); and 4) frequency of use. There were cultural differences in preference for route of administration, with the vaginal route generally least preferred (11). As the most frequent reason cited for discontinuing use of a method is the presence of side effects (20), priorities may depend on whether women are simply rating their preferences for attributes of contraceptives in the course of a survey or actually using a method.

Women's perceptions of menstruation vary widely. Because many contraceptives change menstrual patterns, these perceptions can hinder—or sometimes enhance—acceptance of particular methods. Rural and urban women from 14 cultural groups in 10 countries—Egypt, India (Hindu High and Low Caste), Indonesia (Javanese, Sundanese), Jamaica, Korea, Mexico, Pakistan (Punjab, Sind), Philippines, United Kingdom, and Yugoslavia (Moslem, non-Moslem)—expressed reluctance to use a method that produces amenorrhea. They feel that menstrual bleeding offers regular reassurance that they are able to bear children and denotes youth and femininity, provides evidence that they are not pregnant, and indicates that the body is eliminating impure blood. Many women feel that if "bad blood" is not removed, disease, failing eyesight, and mental illness are likely to ensue. Women tend to confuse the duration of their menstrual periods with the amount of flow. Light bleeding was equated with 1 to 3 days duration and heavy bleeding with 6 or more days duration (52). If family planning providers are to be sensitive to individual concerns, they must be certain that side effects that produce amenorrhea are fully understood by the user and that she is aware that she will not suffer disease or hold "impure" blood in her body if she adopts a particular method. If a method decreases the duration of flow, the user needs to be reassured that the flow will not necessarily be less, or that the shorter duration is not harmful.

Although some women in this 10-country study believe that menstruation is like an illness, they do not necessarily behave as though unwell. Conversely, those not holding this belief were found to exhibit the greatest behavioral changes during menstruation. Even though the women studied said they wanted no changes in their bleeding patterns, many of them—and many women in other countries—are currently using injections and orals that do in fact change the volume and duration of blood loss and do sometimes cause amenorrhea. Among the tradeoffs in the process of deciding whether to use an injection method, efficacy and ease of administration may be more important than changes in menstrual cycle. Such considerations as need for surreptitious use of a method or unavailability of other contraceptive methods may also come into play.

The knowledge that beliefs are often inconsistent with behavior can be put to creative use in the delivery of services. The IUD was unacceptable in the Indian village of Bunkipur because the indigenous interpretation of its mechanism of action conflicted with cultural definitions of health. The people of Bunkipur divide their world (food, religion, medical system, etc.) into "cold" and "hot" attributes, which must be properly balanced in order to maintain equilibrium. Villagers believe that the IUD functions by "increasing the heat in a woman's genital region above the threshold at which conception can occur." Under normal circumstances this heat production is perceived as acceptable, but should the individual contract a disease perceived as hot—such as smallpox, diarrhea, or venereal disease—the combination would induce too much body heat and the individual would die (38). By contrast, perceptions of hot and cold can evoke a positive reaction to a device such as the IUD. In one Mexican village, where the IUD is interpreted as cold and the uterus as hot, villagers believe that after about 3 months the IUD takes on heat and becomes compatible with its uterine environment (39).

An intriguing example of integrating a contraceptive into local cultural religious practices and beliefs comes from the Indonesia family planning program. A family planning official of West Sumatra, a physician, became interested in giving birth control pills to women in such a way as to prevent menstruation during the sacred observance of Ramadan, when Muslims fast from sunrise to sunset. A menstruating woman is regarded as ritually unclean and thus may neither participate in the fast nor pray in the mosque. He reasoned that many women would wish to inhibit menstruation during Ramadan, and having overcome their initial reluctance to use the pill would be motivated to continue its use. According to custom, women may "pay back" missed days after Ramadan is over but receive less pahala (grace from God) for these days. A three-cycle pill had been used elsewhere; this pill was approved for use and as the "Ramadan pill" has become a part of the program (9).

Decreased sexual desire, especially among males, is perceived as one of the most salient disadvantages of any method, yet a method that increases sexual desire is not necessarily more acceptable. Some Indian males, for example, believe that vasectomy increases sexual desire, but this factor is unacceptable because Hindus believe that semen is an important source of strength that should not be depleted by high frequency of sexual intercourse (38). Nevertheless, vasectomy becomes acceptable when Indian men are informed that vasectomy allows the semen to remain in the body, thereby preserving virility, youth, etc. (23).

In some instances, attitudes likely to prejudice people against a method can be mitigated by more pervasive beliefs. In one Mexican village where, except for postpartum amenorrhea, amenorrhea is greatly feared and is widely believed to cause ill health, hemorrhage, and tumors, women often resort to herbal teas and injectable medications to induce menstruation. Contraceptive agents that induce amenorrhea would thus be expected to be totally unacceptable in this setting. Yet the villagers there accept a 3-month injectable that causes amenorrhea because other beliefs supersede these basic fears: they believe that conception occurs through the union of male and female blood or liquid. As oral contraceptives are thought to prevent conception either by weakening the blood of one of the partners, which causes "ill health," or by destroying the joined male and female blood in the uterus, many women hesitate to use them. And since the pill must be taken daily, it is believed that its constant action allows no time for recuperation. The injectable, however, is administered every 3 months, and is thought to give sufficient time for the blood to regain its strength. These beliefs, which reinforce a desire to curb family size, and effective instruction regarding the harmless effects of possible amenorrhea, account for much of the success of the injectable in this setting (37).

Misinformation about reproductive anatomy and function can also cause resistance to the use of fertility planning methods. Some women in Mexico and the Dominican Republic voiced fears that an IUD would either be lost, appear in various openings in their bodies, or cause them to interlock with their mates during intercourse (38).

Clinic locations and hours of operation are important, though sometimes in unexpected ways. Women in a Barbados village, ignoring the clinic specifically set up for them, journeyed instead to a clinic an hour's bus ride away in order to keep their attendance a secret. Clinics should also be open at hours other than those during which women must do their chores.

Lack of privacy is a major problem in family planning clinics in many countries. A study in Equador found that clinic personnel failed to take account of their women patients' sense of modesty. Women in Guayaquil are shy about their sexuality. They are expected to be chaste at marriage, and to display no enjoyment of sexual activity. Menstruation is not discussed, and undressing in front of their husbands causes embarrassment. A clinic visit is at best a difficult undertaking for these women, but the clinics in question made it virtually impossible by interviewing them within hearing distance of other patients, by requiring them to undress in front of male physicians (and remain nude, without gowns or drapes, while being examined), and by asking irrelevant personal questions. Preference for female physicians is documented in India, Puerto Rico, Honduras, Brazil, and Muslim countries (37, 38).

The kind of information clients are given—how much or how little they are told, and the attitudes of those giving the information—can also hinder adoption of contraceptive methods. Women seated in a room where clinic staff members lecture to them, who are given no chance to ask questions, may feel too uncomfortable about the subject matter to acquire the motivation needed to successfully use a method. In one clinic in the Dominican Republic, prospective pill users were told:

> You cannot take them in a disorganized manner, or ever stop taking them, or lend them, or borrow them because these pills are hormones and every one has a distinct function in the body and if you take them incorrectly, a tremendous lack of control will occur and it will be a long time before it is corrected. Ladies, do not stop taking the pills at any time. If you do stop, it will cause hemorrhaging. (37):

The necessity for clinic administrators and staff members to fully understand both the level of their patients' knowledge of reproductive functions and local attitudes toward sexuality cannot be overstated. Program planners must also be aware of the importance of waiting time for clinic patients. In many LDCs lengthy waiting times are apt to lead to client dissatisfaction, but in some cases this interval may provide pleasurable social contact for village women, becoming an inducement to visit the clinic and to accept and continue to use family planning.

As providers of family planning services often favor different methods than do their clients, the distribution of types of methods used in particular countries may be less a function of what is preferred than of what is available. In a recent study of user preferences in India, Korea, the Philippines, and Turkey, the pattern of contraceptive selection differed from the previous pattern in eac' clinic after providers were trained to give balanced presentations of the three methods available—pills, IUDs, or injectables. For example, in Korea for a year prior to the study, 36 percent of the patients had used IUDs and 64 percent pills. When freedom of choice was encouraged, 50 percent chose the IUD. There were also rural-urban differences; rural women in India and Turkey preferred injectables, while these differences were not significant in Korea.

Community concerns: The sociocultural perspective

> I am tired. Look at me. I am nothing but a beast working in the fields and bearing all these children. I don't want any more children, but my husband says I must have as many as come (A village woman, Kenya).
>
> As for religion, its importance in this connection varies. Just 1 week ago, a woman came and said that she wanted to have her IUD removed because she wanted to take communion in church. The priest had told her that if she had an IUD he would not give her the sacrament (A Mexican doctor) (10).

Most people in LDCs live in rural communities, which provide excellent settings for many development efforts, including family planning programs. As the pace of rural to urban migration accelerates, governments are increasingly attempting to provide people with alternatives that will allow them to remain in rural areas. Because the community is usually the local economic, political, cultural, and social base, existing organizations and structures can be utilized to promote family planning acceptance, and community level interactions will continue to have a significant impact on the adoption of small family norms and the utilization of fertility planning methods.

It is extremely difficult to predict the most important factors in people's decisions to use contraception. In comparing Venezuelan and Kenyan women's motivations to adopt family planning, a recent study found that specific contraceptive intentions (as opposed to general attitudes), social support (from friends and family), perceived accessibility of services, between spouse communication, and desire for additional children were the most important predictors of contraceptive behavior (13). Each factor has additive effects; raising the level of any one will increase the level of contraceptive use in the community. Program efforts that concentrate on a single factor are thus likely to be less effective than those that use a balanced approach with some attention to all factors.

The relative impacts of each factor differ in the two countries. Strategies to improve supplies and attitudes in Kenya, where availability, use, and knowledge are low, have different impacts than in Venezuela, where these factors are at higher levels in the population. Thus, during the initial phases of modernization and program development, family planning education, communication, and accessibility of supplies have a strong influence on contraceptive use, but at later stages attitudinal and interpersonal influences and personal situational factors become more important determinants of use. In general, a program that concentrates on diffuse positive attitudes toward family planning adoption might be less successful than one that concentrates on specific attitudes. For example, a program might encourage spacing of births by 3 or more years instead of simply promoting smaller families.

The separate worlds of men and women: husband-wife communication and male attitudes

> The men here believe: Let a woman be free of childrearing and she will go everywhere. They want a woman to have a child every year until she becomes old, while they are free to go gadding about. So if a woman doesn't keep on having children, her husband will get angry and take another wife (A village woman, Kenya) (10).

The marital and childrearing expectations and experiences of men and women can differ greatly. Their status as males and females differs, as do the roles they play with regard to each other, their friends, family, and their children. In most countries men play a dominant role in the major decisions of everyday life. This decisionmaking power—and the extent to which women share in it—has a significant impact on whether a couple will choose to limit the size of their family and adopt family planning.

Family planning programs have historically regarded women as the focus of their efforts. Until recently little attention was paid to the influences of male dominance, male decisionmaking, and spousal communication in the motivation to adopt and use family planning methods. In surveys on the value of children undertaken in seven Asian countries, wives mentioned much more frequently than husbands that children restricted their activities. In questions on attitudes toward children, women more frequently responded that "children tie me down" or "prevent me from doing things" (table 32).

In most LDCs, wives bear most of the burdens and receive few of the benefits of raising large families. A cogent example of these differences is given in the summary of a recently completed survey on male and female attitudes toward family planning in Mexico:

> There exists "widespread" conflict between men and women. The majority of men reject the idea that women should be permitted to work outside the home, while the majority of women endorse this proposition. The majority of men think women are better wives when they have many children, while the majority of women disagree and view women with few children as intelligent, fortunate, concerned about their children, and blessed with considerate, understanding husbands. Many men express fears that their wives will become adulterous if they use contraceptives, and many women believe their husbands wish to keep them tied down with pregnancies so that their power and control over the wife will remain unthreatened (33).

Because of traditional male attitudes, where husbands dominate fertility decisions, perceive the costs of childrearing differently than wives, and believe that women are better off and more trustworthy if they are not using contracep-

Table 32.—Frequency of Responses to Attitudes Toward Children
(respondents could give multiple answers)

	Children tie me down		Prevent me from doing things		Fulfillment	
Country	Females	Males	Females	Males	Females	Males
Philippines....	14%	17%	74%	65%	1%	3%
Turkey	72	34	73	51	4	5
Indonesia	57	15	69	45	0	0
Thailand	13	7	74	60	0	1
South Korea ..	38	25	66	43	7	8
Taiwan	24	19	79	38	4	5
Average	60	22	59	21	4	3

SOURCE: R. A. Bulatao, "On the Nature of the Transition in the Value of Children," papers of the East-West Population Institute, No. 60-A, Current Studies on the Value of Children, March 1979, Honolulu, Hawaii.

tives, there will be substantial pressures for high fertility.

In a comparison of attitudes toward family size in Malaysia and Thailand, Malaysian husbands and wives were found to differ frequently about ideal family size and especially about the desired sex distribution of children. In Thailand, interestingly, spousal attitudes tended to be very close. When asked whether they wanted additional children, 71 percent of the couples agreed (in 51 percent of the couples neither wanted more and in 20 percent both wanted more)(43). In Thailand, men and women have relatively equal status, especially in comparison with other LDCs.

During a 1977 conference in West Africa, the participants, predominantly African women, emphatically stated that "African women did not need to be reminded of the benefits of smaller families; African husbands did." At another meeting a West African man stated, "Men here are never sterile, only women are." That is, a woman who is barren for a certain amount of time will take a clandestine lover to assure her husband of offspring. Both will derive status from offspring but the responsibility is hers. If she fails to produce she will be divorced or her husband will take an additional wife.

Husbands and wives sometimes disagree as to whose decision is final. Results from surveys in Santiago and São Paulo note that although the men feel that husbands and wives are about equally concerned with the number of children and most men report sharing in decisions on family size with their wives, women are more likely to state that the men make the final decision. This same pattern prevails in Mexico, where more women felt that men had the ultimate say (20 percent) than did men (12 percent). Although there is disagreement as to who initiates the discussion of whether to use contraceptives and who makes the final decision, there is ample and consistent evidence that the role of the husband is extremely important in the adoption and continuing use of a method.

In the WHO study of user preferences (53), when women were asked why they were using or would use particular methods, one of the most frequently cited reasons was that the husband liked or would like the method. More than half of the women in India and Turkey reported that the choice of method was made with or by the husband. In the Philippines and Korea, fewer than half of the women reported a joint decision. Joint decisions were more often associated with IUD use, which may be because the husband can sometimes feel the IUD string during intercourse.

In Iran, where women at selected clinics who were given oral contraceptives showed very low continuation rates (only 12 percent after 6 months), husbands were asked to participate in family planning and encouraged to supervise pill use; during the next 6 months the continuation rate rose to 93 percent (35). In Jamaica, the primary reason given by women for discontinuing contraceptive use was the objection of their male partner. In Santiago, Chile, among couples in which the husband was in agreement with contraceptive use, nearly 75 percent had used contraception, but among couples in which the husband was opposed to the use of contraception the figure was only 40 percent. In Kenya, Venezuela, and the Philippines, spousal communication was critically important in decisions to use contraceptive methods. The frequency of discussions on such topics as household budget, education of children, and contraceptive use is less important than the wife's role in the decisionmaking process and her degree of autonomy in various family decisions. Women with more independence are more likely to use contraception (12,13,14).

Women can manage to "beat the system":

> Juana was in her late thirties or early forties. Of her 15 pregnancies 8 children were currently living. Although all her children had been delivered by a midwife, discomfort after her fifteenth delivery sent her to a regional health clinic, where she was told that another pregnancy would endanger her life. She had an IUD inserted and then proceeded to figure out how to involve her husband. She felt both guilt at having taken such a step without consulting him and fear that he would find out and be angry. She approached an American woman, who was a clinic outreach worker, and asked her to help. She had her "drop by" on a specific day, just when Juana's husband would get home. She coached her in great detail on bringing the subject up, beginning with a discussion of the new baby, the doctor's health warning, and then working around to family planning. She warned her friend that she would not speak up in support of the idea; all the approval had to come from her husband. The actual conversation took place just as Juana had predicted. When the discussion on contraceptive methods began, Juana's husband listed many concerns, not the least of which was that Juana's personality would change. Juana did not speak except to say, "whatever he wants" and to bring up potential problems the health worker had not covered. The conclusion was that Juana should have an IUD inserted, but only if the health worker accompanied her. The woman had to fake a trip to the doctor for the insertion (36).

Women who appear to play a secondary role may actually be very good at manipulating their husbands. In one African clinic, women are asked whether their husbands know that they are using a contraceptive method. If not, when a worker comes to give the woman supplies, or during the course of an acceptor survey, the interviewer can use a pretense for her visit if the husband is at home. Although the use of subterfuge between spouses raises difficult questions, some women in LDCs are willing to take extreme measures to avoid or delay pregnancy, and welcome innovative means of introducing family planning into their lives. Women who are innovators in the use of contraception often become enthusiastic supporters of family planning in their communities.

When men agree that their wives should use family planning they often have reservations because of misinformation about the safety, effectiveness, and potential side effects of particular methods. In one village in Mexico, 46 percent of the women thought that their husbands would approve of their using contraception, usually for economic or health reasons. But some were concerned that their husbands might change their minds while intoxicated, as there had been episodes in the village when drunken husbands had attempted to remove their wives' IUDs. Twenty-one percent of the women had never discussed the issue with their husbands and did not know what their reactions might be. One-third of the women reported such negative attitudes as the desire to have many children to gain prestige and to ensure the couple's future economic security, fear that if the wife used contraceptives it would undermine the husband's authority and encourage her sexual autonomy, and fear that illness and even death might result from using contraception. Men's fears, based on rumor and misinformation, are also recorded in a study in Guayaquil, Equador, where some men felt that the pill would "eat the red blood cells" or change a woman's temperament, or that withdrawal would make a man's head swell up (36).

Studies of male contraceptive use indicate that use of current methods (condoms and vasectomy) can be expanded and new methods would find considerable acceptance. In Ghana's Danfa project, men's continuation rates were higher than women's, although this was attributed to their extramarital or premarital affairs, during which there is strong motivation to prevent pregnancy. There is some reserve among men in many groups toward the use of condoms because of their association with prostitutes. Groups of 150 rural and 200 urban men in Fiji, India, Iran, Korea, and Mexico were asked to evaluate the attributes of existing male methods (condoms and vasectomy) and potential male methods (a daily pill and a monthly injectable). Willingness to use a daily male pill if available ranged from 48 percent in Fiji to 77 percent in India. Somewhat lower proportions of men stated that they would use an injectable. Approximately one-third of the men reported that they were currently using no method (11).

As better methods are made available to men, their responsibility for and involvement in family planning is likely to increase. For the short term, it is important that family planning administrators be aware of the influence men have on their wives' fertility decisions and of the need to include men in family planning educational efforts.

Son preference

> "A daughter lets you down twice, once when she is born and again when she marries." Korean proverb (26)

The evidence that couples prefer sons is consistent across all countries, including the United States. In many countries this preference is even more marked in women than in men.

The importance of son preference to fertility rates changes as fertility begins to decline. Several factors are involved. Unless preferences are strong there will be no fertility effect. The amount by which the desired ratio within the family diverges from the natural ratio is important; if the ratio is three or more boys to each girl the effect will be greater than if it is just two boys to one girl. Preferences for family size are related; if family size is large—four or more children—son preference will not have an appreciable effect on fertility because most families will have at least one son. And if contraceptives are unavailable, families will not be able to stop having children when their ideal family size/sex ratio composition is attained (51).

In Japan, Singapore, and Hong Kong fertility is low and son preference has diminished, largely as a result of social and economic development, urbanization, and increased opportunities for women. The birth rate has fallen sharply in China, where, in a radical reversal of traditional attitudes, campaigns are now under way to encourage the one-child family. In these campaigns, a major emphasis is on reducing the preference for sons by raising the status of women.

The implications of son preference are direct and powerful. In societies where son preference is strong, women are directly affected from birth to death. For example, in India in 1972, mortality among girls from birth through 9 years of age was 8 to 23 percent higher than among boys, depending on the region of the country and the 5-year age group (7). Although girls die from the same causes as boys, boys tend to be given better quality medical care and probably more food. As boys are also preferentially educated, they have a better chance to become economically self-sufficient. Women often suffer from anemia and poor health because they must undergo many pregnancies in rapid succession in order to assure sons for their husbands. This cycle of female deprivation is unlikely to be broken until women are given opportunities to increase their self-sufficiency. This can be accomplished when governments undertake active campaigns to educate women (and men concerning new roles for women), assure them equal economic opportunities and legal protection, and convince society that daughters can be as reliable as sons in assuring the old-age security of their parents.

Social networks and organizations

Many existing networks and organizations can have marked impact on adoption and use of contraceptives when they incorporate family planning efforts into their activities, especially women's organizations and traditional midwives who can be trained to deliver family planning information and supplies. In Indonesia, where the local infrastructure is well developed, the family planning program has specifically targeted community leaders and local women's groups as elements of the family planning effort.

Mothers' clubs in Korea are an outstanding example of the role of voluntary organizations—and of women—in family planning adoption and rural development. Groups called Kae had traditionally been formed by Korean women as revolving credit associations and lotteries to provide opportunities for women to accumulate funds for special purposes. The Korean National Family Planning Program decided to distribute contraceptive information and supplies through these mothers' clubs. Their goals were to encourage family planning practice and continuation by example and through social and emotional support to users, to aid overburdened fieldworkers in recruiting new users and supplying contraceptives (pills and condoms), to aid in the introduction of a new method (the pill), and to encourage participation of women in community development activities. These efforts were highly successful both in increasing family planning acceptance and use and in improving the status of women in the community. The clubs have branched out and now encompass cooperative agricultural efforts, community construction projects, and income-producing activities (28).

Photo credit: Agency for International Development

Family planning worker explains IUD-use to Korean mothers

Similar women's organizations are becoming a part of family planning program efforts in Nepal, Thailand, and Egypt. Their leadership includes women professionals who join together to help poorer women, and community political activists who are selected and trained to help deliver family planning information and contraceptives, usually pills (3). Women's credit organizations in Nigeria and other African countries are expanding their functions to include family planning. These grassroots women's groups can be encouraged to aid both family planning efforts and rural development programs (27).

Sixty to 80 percent of births in LDCs occur at home. Hospitals are likely to be too far away or too expensive, and many women prefer to have their babies delivered by local women whom they know. Midwives thus already play a vital role in the community, and with training can improve and expand their services to include prenatal and postnatal care and family planning. In Thailand, 2-week training courses for midwives on aseptic delivery, care of newborns and mothers, nutrition, and family planning have been held since the 1950's. By 1968, some 16,000 women had been trained and provided with UNICEF midwifery kits. In 1965, midwives who used a coupon system to refer women to clinics for IUD insertion were responsible for 5 percent of acceptors in the program's first year. A national program has been under way since 1978 to train all active and interested traditional midwives under age 60, or about 80 percent of the country's total. Although the family planning aspects of this effort may have limited results, improvements in overall maternal and child health care are expected to be significant (8).

National concerns: The role of governments

Significant fertility declines are usually associated with some or all of the following conditions that involve government policy and action with regard to population programs (ordering does not imply relative importance): 1) governmental policies that encourage and promote equal status and opportunities for women, higher age at marriage, and more equitable distribution of wealth and educational opportunities, all of which lead to a higher standard of living; 2) programs designed to bring about a decline in infant mortality; 3) a government policy with explicit goals for reduction of birth or population growth rates; 4) a strong commitment to population planning by the country's leaders; 5) a family planning organizational structure with executive power to mobilize more than one government sector and to coordinate with the private sector; 6) population program funding (usually both external and internal sources); 7) provision of a broad range of contraceptive methods; 8) sufficient numbers of well-trained and motivated family planning program personnel; 9) population and family planning information and communication efforts that effectively reach all sectors of the populace; and 10) direct or indirect incentives that encourage couples to limit the size of their families. The relative importance of these components is not known because country settings differ, and the nature of the country's developmental process and the level of certain key indicators (life expectancy, Gross National Product, nonagricultural labor force participation, literacy rates, etc.) affect the extent to which program implementation efforts can succeed in lowering fertility. But the degree of political will and commmitment and the extent of administrative capacity play major roles in determining the magnitude of fertility decline.

Policy development and formulation

Although most LDC governments have some policy with respect to population, their perceptions of whether population growth rates are satisfactory differ greatly. Nearly all governments allow access to modern methods of contraception as a health measure, and as a human right, but as some actively encourage family planning while others take no direct role, the actual availability of family planning information and supplies varies widely. Most of the world's 50 most populous countries are in Africa and Asia. But only 35 percent of African countries with high growth rates consider their rates too high, while 75 percent of their Asian counterparts hold this view. By contrast, 13 of the 15 most populous countries consider their fertility rates too high (table 33).

The process of policy formulation varies among countries because of differing political and historical factors. In many countries, both the private sector and the demographic community have been instrumental in influencing governments to formulate population policies and implement family planning programs.

Even when rapid population growth is seen by government leaders as a problem, cultural and/or historical constraints may mitigate against the adoption of a specific policy of fertility reduction and the implementation of a government-sanctioned family planning program. The contrast between Latin America and Asia

बस दो या तीन बच्चे
होते हैं घर में अच्छे

Photo credit: Agency for International Development

Family planning slogan that has become famous throughout India reminds cyclists that "two are enough"

Table 33.—National Population Policies

	Government policy		
Country	Perception[a] of birth rate	Policy and interventions[b]/ population growth or birth rate goals	Access to family planning services[c]
1 China	H	— (BR)	4
2 India	H	— (BR)	4
3 Indonesia	H	— (PG)	4
4 Brazil	S	0	4
5 Bangladesh	H	— (BR)	4
6 Pakistan	H	— (BR)	4
7 Nigeria	S	0	3
8 Mexico	H	— (PG)	4
9 Vietnam	H	— (PG)	4
10 Philippines	H	— (PG)	4
11 Thailand	H	— (PG)	4
12 Turkey	H	— (BR)	4
13 Egypt	H	— (BR)	4
14 Iran	H	— (PG)	4
15 South Korea	H	— (PG)	4
16 Burma	S	0	2
17 Ethiopia	S	0	3
18 South Africa	H	—	4
19 Zaire	S	0	3
20 Argentina	L	+	1
21 Colombia	S	0	4
22 Afghanistan	H	0	4
23 Morocco	H	— (BR)	4
24 Algeria	S	0	4
25 Sudan	S	0	4
26 Tanzania	S	0	4
27 North Korea	S	=	4
28 Peru	S	0	4
29 Kenya	H	— (PG)	4
30 Venezuela	S	0	4
31 Sri Lanka	H	— (BR)	4
32 Nepal	H	— (BR)	4
33 Malaysia	S	0	4
34 Uganda	H	—	4
35 Iraq	L	+	2
36 Ghana	H	— (PG)	4
37 Chile	H	0	4
38 Mozambique	S	=	4
39 Cuba	S	0	4
40 Kampuchea	L	+	1
41 Madagascar	H	0	3
42 Syria	S	0	4
43 Cameroon	L	0	3
44 Saudi Arabia	S	=	1
45 Ecuador	S	0	4
46 Ivory Coast	S	=	2
47 Zimbabwe	NA	NA	NA
48 Guatemala	H	0	4
49 Angola	S	0	3
50 Upper Volta	S	0	2

NA = Not available

[a] Perception: S-Satisfactory fertility level; H-Fertility too high; L-Fertility too low.

[b] Policy and interventions:

Stated policy and interventions to increase population	+
Stated policy and interventions to decrease population	—
Stated population growth reduction goal	(PG)
Stated birth rate reduction goal	(BR)
Policy to maintain present population	=
No interventions	0

[c] Access to family planning services: 1-Restricted by government; 2-No support by government; 3-Indirect governmental support; 4-Direct governmental support.

SOURCE: United Nations, *World Population Trends and Policies: 1978 Monitoring Report, 1980*.

demonstrates the importance of historical, political, and cultural traditions. In general, Asia has had a relatively long tradition of government family planning programs while Latin America has traditionally relied on the private sector. Government policies have not always been explicit in Latin America but government support has been unobtrusively provided to private family planning efforts. Ness and Ando (22) argue that Latin America has implemented few government programs because there must be a perceived "legitimacy" for the government to implement such efforts. This legitimacy stems from underlying value sets of the nation's cultural groups. In Latin America there is deep-seated antipathy toward government-implemented family planning among diverse groups: conservatives oppose contraceptive use because of commitment to Roman Catholic values; social reformers have supported limiting population growth but have been suspicious of the U.S. emphasis on family planning; and revolutionaries oppose population growth limitation either from strict Marxist opposition to Malthusian theory or from objection to any social reform that reduces pressures for radical change. Because Latin America has a high proportion of countries that support fertility reduction without specific public policies for fertility planning, successful family planning programs require a substantial degree of commitment on the part of strategic groups of leaders. Latin America's general public appears to be in a greater state of readiness for serious collective population growth limitation than do some of its leaders (22).

By contrast, Asia has taken the lead in government-sponsored fertility reduction programs. The greater penetration of modern colonialism in Asia produced strong nationalist movements which led to strong political and organizational commitment to economic development and centralized economic development planning. These antecedents led, finally, to political decisions for population growth limitation by planning authorities, justified largely on economic arguments. These decisions led in turn to government organizations to promote fertility planning (22).

There are clear differences in outcome between policies with demographic objectives and those aimed primarily at improving general health care. About two-thirds of the countries with policies to reduce population growth have either strong or moderate programs. When the effects of social setting and population program are compared, more specific policies are shown to be associated with greater declines in the crude birth rate after controlling for social setting (table 34); only a high social setting can overcome a weak policy position. (Social setting is an index of socioeconomic development level used by Mauldin and Berelson.)

Three very important considerations lie behind policy as a level of intervention—the country's degree of political commitment, its administrative capability, and the ability of government planning and statistical agencies to analyze projects and programs with respect to their population dynamics. Experience to date indicates that a nation's political elite must be committed to population planning efforts to the extent that it supplies the program—whether public, private sector, or both—with ample resources. Highly qualified personnel must be chosen to administer the programs, bureaucratic impediments to program effectiveness must be removed, and program goals given high visibility in the government's development plan. Administrative capability is generally correlated with the country's level of development; if levels of skills are low and basic infrastructure is weak, institution-building must be a part of the program. This is a slow, expensive undertaking. If infrastructure and skills are in place and only

Table 34.—Decline in Crude Birth Rate (percent) by Social Setting and Nature of Family Planning Policy 1965-75

Social setting	To reduce population growth rate	For other than demographic reasons	No program and unknown
High	28(11)	21(7)	3(6)
Upper middle	15(14)	4(6)	2(4)
Lower middle	7(4)	4(8)	2(11)
Low	1(2)	1(4)	2(17)

Number of countries in parentheses.

SOURCE: P. W. Mauldin, B. Berelson, Z. Sykes, "Conditions of Fertility Decline in Developing Countries, 1965-75," *Studies in Family Planning* 6(5): 89-147, The Population Council, New York.

specific training programs are required, such training programs can be very cost effective. When the social setting is less than congenial to the idea of family planning, political commitment and administrative capability are crucial (40).

Decline in infant mortality

In the ongoing debate over the relationship between infant mortality and fertility, it has generally been believed that infant mortality rates must begin to decline before fertility rates will do so. The underlying assumption is that couples will continue to try to replace children who die in infancy until they have a sufficient number to insure the survival of at least several. Now, however, new evidence from the European demographic transition and from many LDCs shows that fertility can begin to decline in countries with high rates of infant mortality. When various neglect behaviors are implemented toward unwanted children, their risks of dying rise, and high infant mortality may be associated with high fertility (see also Tech. Note A, ch. 4). Although the relationship is complex, both MCH and family planning programs respond to an important humanitarian need to reduce death rates among infants, their siblings, and their mothers.

Demographic information, education, and communication efforts

Up-to-date demographic information and statistics for program evaluation are crucial to policy development, and to the implementation and functioning of family planning programs. Reliable demographic information from censuses and surveys must be available to inform government leaders of the dimensions of population growth in their countries. Data collection to document the initiation, growth, and change of programs is essential, as is the capacity to analyze demographic data and recognize the consequences of population growth in terms of a country's economic and social goals.

Parallel to this demographic support are IEC efforts to increase awareness of the effects of rapid population growth on socioeconomic goals, and to explain what family planning is and where services are available. IEC efforts range from mass media campaigns to the information that individual family planning workers give personally to their clients. Knowledge of the ability to control one's fertility favorably influences use of fertility planning methods; this use, in turn, increases knowledge and receptivity to education efforts which, in turn, increase use of family planning methods (49). This constant feedback process can occur quickly—as evidenced by the rapid spread of family planning in Mexico, Indonesia, Colombia, Brazil, and Thailand—and can establish family planning as a subject of open and free discussion.

Strategies for the structure and functioning of family planning programs

Contraceptives have usually been available on a limited basis prior to the establishment of government programs. Often the private sector, including the medical profession and social scientists, has been active in alerting government officials and the population in general to the need for family planning services. These services have in may cases been provided by local affiliates of IPPF.

In Colombia, the medical community and voluntary organizations played a major role in encouraging the government to adopt a population policy and to sponsor and implement a family planning program. The Colombian Association of Medical Schools (ASCOFAME) through its division of Population Studies (DEP) demonstrated the existence of the country's population problems by gathering data on fertility and rates of illegal abortion and by generating awareness of Colombia's demographic situation among both medical and academic professionals and the Colombian people. Through the combined efforts of ASCOFAME, Profamilia (IPPF's Colombian affiliate), other government and private organizations, and external support, public health personnel were trained in the delivery of family planning services, these services were made available, and the government was encouraged to undertake a national program. Much of the institutionalization of family planning was thus taking place while the government was formulating its policy.

Governments must consider not only the structure of their official programs but the relative contributions and continuing roles of those organizations whose family planning efforts precede the implementation of a national program. ASCOFAME, Profamilia, and the health ministry continue to deliver services in Colombia; each organization fulfills varying roles according to its individual strengths. A parallel experience is seen in Malaysia, where the private family planning organization and government-run program work hand-in-hand.

Most government family planning programs are located in health ministries or in the maternal and child health sections of health ministries. This is more likely to be the case when policies are primarily aimed at health care, although many policies with specific demographic objectives are implemented through programs in the health ministry. Countries also have the option to rely heavily on the private sector. In these cases the private sector can include the medical community as well as affiliates of such nongovernmental organizations as IPPF. Brazil is a country where cultural and religious factors mitigate against a strong population policy at the national level while family planning activities proceed in various sectors through state governments and through extensive use of the medical community and nongovernmental organizations. The national government simply does not bar these activities.

Family planning programs located in health ministries can encounter problems when family planning priorities are submerged by the demand for basic health services. In Kenya, where there are fewer than 15 doctors for each 100,000 people and it is impossible for doctors to reach all patients even for the most basic of health services, family planning becomes a low priority health measure. In Korea, by contrast, there are enough doctors to provide basic health care and they have been trained in family planning, incorporated into the system, and paid for delivery of family planning services.

Locating a program in the health ministry can cause problems if there is no vehicle (an executive governing board or some form of coordinating and executive power) to expand the program beyond the ministry. For example, health ministries are not usually equipped to launch major education and information campaigns, nor do they have the marketing skills to launch projects to distribute contraceptives through commercial channels. In addition, the health ministry usually focuses on maternal and child health, which is important but often limits male access to and involvement in family planning.

One strategy used by several countries is to establish a coordinating board that has executive power to coordinate the various activities of a family planning program. Thus, as in the case of Mexico, such a board can coordinate the activities of various ministries and the private sector in order to reach populations with different characteristics. Mexico's coordinating board consists of the directors of the major sources for health care and family planning in the country. The board, called Coordinacion General del Programa Nacional de Planificacion Familiar, is under the direction of an executive coordinator within the Ministry of Health, and is composed of all cabinet members and heads of institutions in the health sector, the Directors-General of the Mexican Social Security Institute and Institute of Social Security for Government Workers, the Undersecretaries of Planning and of Health and Welfare, and the Director-General of the National System for the Integral Development of the Family. The board coordinates and streamlines the family planning effort of the existing public health infrastructure in order to expand services, especially to rural and marginal zones, and is responsible for setting standards, creating new programs, and monitoring the activities of all family planning service organizations, public and private, in Mexico. It is a semiautonomous state agency with close access to the President through the Executive Coordinator and the Secretary of Health and Welfare.

Indonesia also has an autonomous coordinating board. Indonesia's first 5-year development plan, introduced in 1969, set a target of 3 million family planning users by 1973-74. The National Family Planning Coordinating Board (BKKBN) was set up as a separate board with direct responsibility for reporting to the president on family planning activities. This board does not directly provide contraceptive services to the public; instead, it coordinates the work of the various ministries and private institutions that provide contraceptives and conduct informational and motivational campaigns. BKKBN employs fieldworkers who complement staff from other ministries.

Unfortunately, few data are available on how the structure of family planning organizations relates to the effective functioning of the family planning system. Some data are available from structure charts of organizations, but how communication channels work or don't work and the implications of structure for the functioning of the system remain to be investigated (24).

Integration of family planning with other development programs

The belief that integrating family planning into other development and welfare efforts is essential to the success of family planning programs is being given wide currency at a time when the success of nonintegrated family planning programs is being well-documented around the world. Questions thus arise about the evidence supporting the efficacy of integrating family planning with other programs.

The rationale for integration and the criteria used as evidence for its need must be carefully examined. A government considering an integrated program must first consider its goals, its target population, the existing infrastructure, and how the integration is to be carried out. The process must be carefully planned because different procedural actions are required when integration occurs at the service delivery level than when one ministry is to become a part of another.

"Integration" usually means integrating family planning with health or MCH. An inherent problem is that the addition of a new program to an already fragile program is apt to weaken both. Ministries of health are typically weak in LDCs because of the severity of health problems and the lack of trained personnel. In the MCH approach, sick women and children are given priority. If special hours and specific personnel are not delegated for family planning, services will not be delivered. If the family planning budget is integrated into that of the health ministry, funds earmarked for family planning may be diverted to more acute health needs. As MCH clinics primarily serve women, there is little motivation or opportunity to incorporate men into family planning activities. Services tend to remain clinic based as health ministries rarely command the educational or marketing expertise necessary to launch non-clinic-based programs. The rationale for integration into other sectors—that a plateau is reached in a clinic based approach—may be valid but it may also be true that a weak administrative infrastructure causes a leveling off of new users of contraception.

Even when there is a definite goal the process of integration crosscuts several organizational concerns. Are the linkages to be temporary or long term? Which development sectors are to be linked? Is the linkage to be along administrative or service lines, or both? Does the target group—rural or urban, male or female, married or single—warrant an integrated approach? UNFPA has made a number of recommendations based on their examination of the experience of several types of integration in several countries.

Integration of family planning with rural development activities can help to improve the program in specific circumstances:

- Because many rural people are extremely poor and isolated, current clinic-based programs are unlikely to reach them, and linking family planning with other development activities—especially with existing structures and with the rural community itself—can increase the availability of all services.
- Where there are politically influential groups who are averse to family planning, programs can be linked to more popular

Photo credit: Agency for International Development

Mobile family planning unit visits a remote village in the Turkish countryside

services in order to make family planning more acceptable.

- It is preferable to focus on integration that links specialized services at the point of service delivery, and to approach with caution integration that creates large umbrella activities. Experience has shown that the delivery of other services can be added after the delivery of family planning services is established, e.g., addition of oral rehydration kits to family planning outreach workers. Care must be taken not to overburden workers with too many interventions in settings where unmet health needs are acute.

Although integrated programs may achieve some long-run efficiencies and cost reductions, they require large investments in resources, especially in the beginning. Integration cannot be effective when existing personnel are given heavier workloads without being given the necessary additional resources (23,41,47). In general, integrating family planning with other development interventions works best at the service delivery level, when the needs of the target group are carefully considered, and when interventions are simple and straightforward. When a family planning service delivery system is strong, other interventions can strengthen the total program. In Thailand, for example, the local production of methane gas is among a number of program interventions incorporated into the family planning commodities delivery system. In Mexico, the distribution system set up for the government's PROFAM brand of contraceptives was so successful that a major pen manufacturer asked to include the PROFAM network of pharmacies in its distribution system.

Considerations governing the contraceptive methods provided

Among the most crucial choices a government must make is that of the methods to be provided in the country, both within and outside the program. Legal considerations and cultural and individual preferences must be carefully assessed. Each method has its logistical requirements: supply considerations, warehousing support, transport, need for specially trained personnel, specific types of information and education campaigns, knowledge of brands available, shelf life, and cost. Import regulations apply or are determined by a government's decision regarding manufacture of contraceptives within the country, which must take into account the number and kinds of methods to be distributed. Product safety and reliability considerations are important, as is cultural acceptability, and who will prescribe and who will use the methods.

Six major factors—in addition to cultural considerations—generally determine the adoption and use of fertility planning technologies by governments and national family planning programs and will continue to do so in the future. They are: 1) cost of the technologies, 2) adequacy of information about the technologies, 3) adequacy of sources of supply of technologies, 4) nature of government policies with respect to importing goods, 5) nature of laws, policies, and commodity financing arrangements pertaining to the technologies themselves, and 6) capacity of program administrators to arrive at and implement technical decisions about these technologies.

The fundamental problem that governs technology transfer in the fertility planning field is the still unresolved question of who will bear the very substantial costs associated with the development, distribution, and use of both present and future technologies. Many future technologies that could be of use in LDCs will be much more costly than existing technologies either because they will be sold at higher prices than current methods or because it will cost more to acquire the rights and technical capacities to manufacture them locally. These problems of cost will have to be resolved at both national and international levels among donors who purchase commodities for LDC programs.

For example, since costs are high, program managers must have sophisticated knowledge of the exact contraceptive, packaging, labeling, and quality control specifications they want if contraceptives are purchased from private sector companies. Costs can often be reduced if bulk purchases are made. Purchasing from the private sector offers the advantage of a wide choice of products and, usually, high quality, prompt delivery, and good service. In contrast, purchase of contraceptives from manufacturers that sell to donors such as AID, UNFPA, IPPF, FPIA, etc., reduces cost and offers high quality products and arrangement of procurement, shipment, and customs clearances. However, only a limited choice of products may be available. Given current high costs and the expected increases in use of contraceptives, many LDCs will still prefer this route. It is also likely to be the best option for procurement of new contraceptive methods because of the high costs associated with other options.

Another option for an LDC government is to manufacture the commodities locally. (see app. D for a detailed description of the logistic requirements and processes involved in establishing local manufacture of contraceptives in LDCs.) The major advantages of local manufacture include the benefits of increased local employment, technical skills, and output, and, sometimes, reduced expenditures of foreign exchange currency. Packaging and labeling can be designed to meet local specifications and needs. The interval between manufacture and use of product is reduced, which is especially important for products with limited shelf life. Major disadvantages include the difficulty of retooling for new technologies, the narrower range of choices available, and potentially higher costs. Most importantly, unless a country is able to commit the technical and managerial resources necessary for the highly sophisticated production of contraceptives, problems with reliability of manufacture and product quality can occur.

If a government decides to build up local production capacity through strict foreign exchange controls and import substitution policies, planning and finance ministries will find it difficult to approve the purchase of new technologies manufactured abroad. And, as was discussed in chapter 6, because new methods are most likely to be developed in MDCs in the next 20 years, governments will need to import them, at least until they can establish local manufacturing capabilities. Because governments are likely to favor local production in the future, there could be severe delays in local availability of many new technologies and blocked access to others.

In addition to these economic considerations, technical and programmatic factors determine the method mix in LDCs now and will continue to do so in the future. The importance of the effective dissemination of information about the technologies, on which the transfer of technology depends, cannot be exaggerated. For example, there are three major variants among IUDs, and these are further subdivided into almost 100 specific products or techniques. Oral contraceptives are available in more than 40 different formulations. Brands with different formulations and dosages often differ in packaging, cost, shelf life, and side effects. Efforts are now under way to provide program administrators with up-to-date information on different methods; PIACT, the Program for Introduction and Adaptation of Contraceptive Technology, is disseminating comprehensive information on contraceptives to LDCs. Once an administrator decides which contraceptives to purchase, the sources of supply must be chosen. Contraceptives can be purchased from private manufacturers or from special manufacturers that sell to the public sector, obtained as gifts from international donors, or manufactured locally. Each source has attendant advantages and disadvantages.

Levels of expertise and infrastructure are important in contraceptive choice decisions. Even if all the information could be listed in a compendium and constantly updated, people would need special training in order to adequately evaluate the properties of various methods (36).

Each decision about the method mix in a particular country is extremely important and has its ramifications and repercussions. The administrator must not only be aware of user preferences and logistical requirements, but have up-to-date information and be able to assess medical properties of the methods. These considerations are likely to become more complex as overall prevalence rates increase and as new methods are introduced.

Commercial retail sales and community-based distribution systems

When a country has determined the structure of its program, the development of service-oriented operational strategies is needed. Governments can choose clinic-based systems for government-provided services, heavy reliance on existing health facilities and utilization of private physicians, distribution through nongovernmental private voluntary organizations, retail sales distribution systems, or community-based distribution systems, or they can mobilize all of these sources. Among the innovative approaches in current use are community-based distribution (CBD) programs, and commercial retail sales (CRS). These systems incorporate subsidized government sales through pharmacies, local boutiques, village centers, and distribution through institutions and individuals, and involve people who are closely linked to the community and well-known to the clientele they serve. These workers may be village elders, midwives, merchants, or volunteers who assume responsibility for any number of tasks, including contraceptive storage, program administration, and transmittal of family planning education and information. Approaches differ from country to country, but several characteristics are common to successful programs. These include prices that are affordable to the target community, culturally appropriate methods, convenient dissemination techniques, integration of family planning with other health, nutrition, and socioeconomic development delivery systems, providing IEC materials (including population education) along with methods, efficient and regular systems for resupply of contraceptives, and adequate methods of program evaluation.

Innovative advertising has helped make discussion of contraception and individual purchase of contraceptives open and acceptable. Buyers would rather ask for a "Panther" in Jamaica, a "Preethi" ("joy") in Sri Lanka, or a "Raja" in Bangladesh than a condom.

> Raja (the Bengali word for "king") is the name of the condom which is characterized by a picture of a playing card king, symbolizing strength and power. The pill is called Maya (affection) and is associated with a picture of an attractive woman. The familiar Raja picture adorns the sails of sea vessels delivering contraceptives to outlying areas. The picture has become a part of the country's successful mass media campaign, which has included newspaper, cinema, and TV advertising. This has resulted in Raja and Maya being the most heavily promoted consumer items in Bangladesh, next to cigarettes. The Maya radio jingle is the most recognizable song on the radio in Dacca (1).

By April 1981, Raja and Maya were available in some 69,000 outlets in Bangladesh and monthly sales averaged 4 million Rajas and 44,000 cycles of Maya.

Because CRS projects offer commodities for a price, there is ongoing disagreement over whether the contraceptives should be free (as is often the case in clinic or community-based programs), or whether a small charge will make the commodities seem more valuable. Both approaches have been successful, and social marketing efforts have substantially reduced consumer costs in many countries (table 35).

Social marketing/CRS programs have had a number of political and administrative problems. The need for mass media advertising campaigns in support of CRS programs can create political difficulties in securing government approval of these efforts, and traditional attitudes toward and laws governing the use and sale of contraceptives make program implementation difficult. These projects have, however, expanded existing family planning programs, have been highly cost effective, and have spurred increases in contraceptive sales. Countries with CRS programs are listed in table 36.

Table 35.—Prices to Consumer of Contraceptives Available Through Commercial Retail Market and Through Social Marketing Programs in Selected Countries
(in U.S. dollars)

Country	Contraceptive	Commercial retail price[a]	Price through social marketing program[a]
Bangladesh . . .	Condom	0.08-0.12	0.01
	OC	0.80-1.50	0.05
Colombia	OC	0.50-1.10	25-45
Costa Rica	OC	1.50-2.50	0.35
El Salvador . . .	Condom	0.10-0.30	0.04
	OC	1.00-3.56	0.40
Indonesia	Condom	0.07-0.20	0.016
Jamaica	Condom	0.45-0.85	0.03
	CC	2.00-2.25	0.17
South Korea . .	Condom	0.50	0.05
	OC	0.60	0.30
Mexico	Condom	0.30	0.11
	OC	1.00	0.39
	Foam	4.25	1.91
Nepal	Condom	[b]	0.013
	OC	0.50-1.10	0.13
Sri Lanka	Condom	[c]	0.013
	OC	0.85-1.50	0.15

[a] Price (in U.S. dollars) per cycle of oral contraceptives, per condom, or per container of pressurized foam.

[b] None available before social marketing program.

[c] Negligible sales of brands other than *Preethi* since 1974.

SOURCE: D. L. Altman and P. T. Piotrow, "Social Marketing: Does It Work?", *Population Reports*, series J, No. 21, January 1980, Population Information Program, Johns Hopkins University, Baltimore, Md.

While CRS programs are built into existing commercial marketing networks, CBD programs utilize existing social structures and institutions and were the first extensions, in LDCs, of traditional clinic-based family planning services. Distribution points include family planning outreach workers, mobile delivery units, and contraceptive resupply depots. CBD programs evolved from demand for better access to services and a lack of trained health personnel and facilities in remote rural areas, and operate in a variety of ways. Some provide services at a central point in a village, as in Indonesia, while others feature door-to-door service by way of household canvassers, as in Egypt and Bangladesh.

Although some of the CBD projects now active in 38 countries are relatively small, there are large-scale operations in Bangladesh, Egypt, Indonesia, India, Mexico, Nicaragua, Thailand, Colombia, Jamaica, Philippines, Korea, and Sri Lanka (table 37).

Current evidence shows that many kinds of household and village distributions can be more effective than clinic programs. Rates of acceptance, continuation, and prevalence consistently fall within—rather than below—the "ac-

Table 36.—Countries Having Commercial Retail Sales Programs, 1980

Asia
- Bangladesh
- Fiji
- Hong Kong
- India
- Indonesia
- South Korea
- Malaysia
- Nepal
- Pakistan
- Philippines
- Sri Lanka
- Thailand

Latin America and the Caribbean
- Antigua
- Barbados
- Colombia
- Costa Rica
- Guatemala
- Haiti
- Honduras
- Jamaica
- Mexico
- Panama
- St. Kitts/Nevis
- St. Lucia
- St. Vincent
- Uruguay

Middle East/North Africa
- Egypt
- Morocco
- Tunisia

Sub-Saharan Africa
- Ghana
- Kenya
- Mauritius

SOURCE: *Family Planning in the 1980's: Review of the Current Status of Family Planning* (Annex to the Background Document), International Conference on Family Planning in the 1980's, April 1981, Jakarta, Indonesia. Cosponsored by the UNFPA, IPPF, and the Population Council.

Table 37.—Countries Having Community-Based Distribution Programs, 1980

Asia
- Bangladesh
- China
- Hong Kong
- India
- Indonesia
- South Korea
- Malaysia
- Nepal
- Papua New Guinea
- Pakistan
- Philippines
- Sri Lanka
- Taiwan
- Thailand

Latin America and the Caribbean
- Brazil
- Colombia
- Dominican Republic
- Ecuador
- El Salvador
- Grenada
- Guatemala
- Haiti
- Honduras
- Jamaica
- Mexico
- Nicaragua
- Panama
- St. Lucia
- St. Vincent
- Trinidad and Tobago

Middle East/North Africa
- Egypt
- Lebanon
- Morocco
- Sudan
- Tunisia

Sub-Saharan Africa
- Ghana
- Liberia
- Nigeria

SOURCE: *Family Planning in the 1980's: Review of the Current Status of Family Planning* (Annex to the Background Document), International Conference on Family Planning in the 1980's, April 1981, Jakarta, Indonesia. Cosponsored by the UNFPA, IPPF, and the Population Council.

Table 38.—Continuation Rates for OCs in Clinic-Based and Community-Based Programs: Village Family Planning Program, Indonesia

Time period	OC users resupply depot	
	Clinic	Village
12 months	65.9	76.3
24 months	47.7	61.5
36 months	33.1	47.9

SOURCE: J. R. Foreit, M. E. Gorosh, D. G. Gillespie, C. G. Merritt, "Community-Based and Commercial Contraceptive Distribution: An Inventory and Appraisal," *Population Reports*, series J, No. 19, March 1978, Population Information Program, Johns Hopkins University, Baltimore Md.

ceptable" range of clinical programs (5). Continuation rates among oral contraceptive users in Indonesian CBD programs are higher than those among clinic-based users (table 38). Although provision must be made for clinical support for management of side effects of methods, costs of operating CBD programs are competitive with clinical approaches. Because volunteer personnel are extensively used, these costs are expected to decline.

The availability of family planning services

Few assessments of the conditions of fertility decline in LDCs take account of differences in the availability of contraception among countries because of the paucity of reliable data. Yet these differences are at least as great as the socioeconomic differences among LDCs. Therefore, to examine rural-urban and education differentials in contraceptive use without first ascertaining whether distribution of services to urban, and better educated, women varies is to ignore a causal link in the factors influencing the use of family planning. In order for contraception to be used, information, services, and supplies must be available (2). Services and supplies are unavailable if the financial cost is too high, if clinics are open at hours convenient only to clinic staff, if supplies are insufficient or privacy is lacking in clinics, etc.

Availability research carried out in the course of recent national fertility surveys has focused on a single index of availability, the perceived availability of family planning services and their relationship to contraceptive use. Rodriguez (34) analyzed the perceived accessibility (accessibility and availability are used interchangeably) of services in terms of women's perceptions of travel distance to the nearest outlet and the relationship of this distance to use of family planning methods in Nepal, Colombia, Costa Rica, Korea, and Malaysia. In Nepal, only 6 percent of currently married women know where contraceptives are available, and only 2 percent know of a place less than 2 hours away from their homes. In Nepal, 27 percent of those who live within 2 hours of an outlet use a method in contrast to 14 percent of those who live within a day or more of a source. In every country except Costa Rica (where virtually everyone knows of an outlet nearby), the closer the source the more likely women are to be using it (table 39). Traditional associations with education and rural-urban residence are not as strongly tied to use of contraceptives when the nearness of an outlet is controlled. The reduction in association is most marked in Nepal, where sources are rarely available in rural areas.

The relationship between current use of contraceptives and knowledge of the distance to an outlet is shown for 10 countries in table 40. The level of motivation is obvious when even 30 or 40 percent of women who live 30 minutes or more from an outlet are using contraception. Efforts to provide more accessible services could result in higher levels of use.

Incentives

Because incentive schemes to increase family planning vary considerably, their impact on fertility cannot be adequately assessed. Nevertheless, they have engendered considerable controversy—less because the incentives themselves are inherently discriminatory or coercive than because of the ways in which they have been implemented. India's widely publicized sterilization campaigns are a prime example.

An incentive is here defined as something of value (usually, though not always, financial) given by a government or an organization to an individual, couple, or group to encourage certain fertility planning behaviors. Both the "value" and the "behavior" must be specified for each type of incentive scheme.

Value is usually specified in terms of payments in cash or commodities (government provision of family planning services and/or commodities is excluded because many governments already provide these services free or at minimal cost), but can be in the form of indirect benefits. In Singapore, for example, access to better education is offered as an incentive to encourage couples to have small families. Education is free for their first two children, but costs rise for third and higher order births.

The desired fertility planning behavior is specified by the government or organization

Table 39.—Percentage of Currently Married Women Using an Efficient Contraceptive by Perceived Availability of Services

		Colombia	Costa Rica	South Korea	Malaysia	Nepal
Total contraceptive prevalence		30	53	27	24	2
Perceived availability	(Nepal)					
5-15 min.	0-2 hrs.	44	55	32	33	27
20-30 min.	3-8 hrs.	41	56	[illegible]	26	14
≥60 min.	≥1 day	36	56	27	24	15
Knows no outlet		9	35	6	5	1

SOURCE: G. Rodriguez, "Family Planning Availability and Contraceptive Practice," *International Family Planning Perspectives and Digest*, 4(4): 100-115, 1978.

Table 40.—Contraceptive Use Among Currently Married Women Who Knew a Family Planning Source, and Travel Time to Outlet

Country date and survey	Percent currently married women using contraception			
	Know outlet			Do not know outlet
		Travel time		
	Total	Less than 30 minutes	30 minutes or more	
Costa Rica, CPS, 1978	67.5	68.8	63.0	(13.7)
Panama, WFS, 1976	59.9	NA	NA	38.2
Colombia, WFS, 1976	55.2	57.2	51.4	18.3
Thailand, CPS, 1978	52.9	56.6	44.8	(10.7)
South Korea, CPS, 1978	50.7	52.0	46.9	(3.4)
Mexico, WFS, 1976	50.3	52.4	48.6	10.8
Indonesia, WFS, 1976	47.6	NA	NA	6.7
Mexico, CPS, 1978	47.4	51.4	32.2	15.5
Philippines, WFS, 1978	43.9	47.2	36.0	9.9
Malaysia, WFS, 1974	39.3	42.3	34.7	10.9
South Korea, WFS, 1974	39.0	41.2	36.9	9.4
Kenya, WFS, 1978	13.0	15.5	12.3	2.1
Pakistan, WFS, 1975[a]	7.7	NA	NA	4.4

NA = Not available.

[a] For Pakistan the data relate to women who had met a family planning worker only. Numbers shown in () were based on fewer than 20 cases.

SOURCE: J. W. Brackett, "The Role of Family Planning Availability and Accessibility in Family Planning Use in Developing Countries," paper presented at the WFS Conference, London, July 1980.

providing the incentive, and in most cases is the adoption of a particular method—the IUD, for example—or consent to a sterilization. In Singapore, limiting family size to two children is the desired birth planning behavior.

In some incentive schemes payment is made to a "diffuser," who motivates individuals to use specific methods, to a "provider," such as the individual who inserts an IUD, or to a community when its percentage of couples practicing contraception reaches a target level.

Most current schemes usually include the following elements: the government is the grantor of incentives; payment is made to individuals rather than groups; funds come from the program budget; cash rather than in-kind incentives are used; immediate and single, rather than installment and deferred, payments are made; payments are of a fixed amount and are made at the time of adoption of a family planning method; and incentives are positive rather than negative.

Table 41 contains a listing by country of incentives paid for IUD insertion and contraceptive sterilization (no countries are paying incentives to pill or condom users). In Bangladesh, India, Pakistan, and the Republic of Korea, incentives are paid to the diffusers. In most Asian countries the medical practitioner who inserts IUDs is reimbursed on a fee-for-service basis.

Voluntary sterilization has been a traditional focus of incentive schemes. Many payment schemes have been tried; clothing was given to those undergoing sterilization in India and food rations were offered in India and the Republic of Korea. In 1974, Singapore relaxed certain of its disincentives for families who chose sterilization. If one parent is sterilized, the fourth child, who would otherwise be given lower priority in primary school admission, is given the same priority as the first three, and women with two or more living children, who are not otherwise entitled to paid maternity leave, receive this benefit if they choose postpartum sterilization (table 43).

Governments that elect to implement incentive schemes must plan carefully to avoid compromising individual choice. Incentives cannot substitute for full availability of services, and although culturally defined, questions of coercion must be carefully considered. The often overlooked aspect of coercion is the social coercion to have more children than are wanted.

Table 41.—Incentives Provided for IUD Insertion, by Country (1975-77)

Region and country	Incentives provided to diffuser/ provider	Fees charged to user in U.S. dollars
Africa[1]		
Botswana	—	0.59
Egypt	0.58-1.15	Free
Gambia[a]	—	0.58
Ghana	—	0.79-0.98
Kenya[2]	—	Free
Mauritius	3.00-4.00	Free
Morocco	—	Free
Zimbabwe	—	3.54
Tunisia	0.50-2.00	Free
Uganda	—	0.70
Asia and Pacific		
Bangladesh	0.40-0.80	Free
China[3][b]	—	Free
Fiji	—	Free
Hong Kong	—	1.10[e]
India[c]	0.14-0.27	Free
Indonesia	—	Free
Malaysia	—	Free
Nepal	0.24-0.47	Free
Pakistan[d]	0.25-0.60	0.05
Philippines	—	Free
South Korea	0.42-1.05	Free
Singapore	—	1.40-2.00[e]
Sri Lanka	—	Free
Thailand	—	Free
Turkey	—	Free
Americas		
Chile	—	Free
Colombia	—	Free
Costa Rica	—	Free
Dominican Republic	—	Free
El Salvador	—	Free
Guatemala	—	0.25[e]
Honduras	—	Free
Jamaica	—	Free
Mexico	—	Free
Nicaragua	—	Free
Puerto Rico	—	Free

[a] Data for 1973.

[b] China provides 18 days leave for induced abortion.

[c] India is the only country to pay IUD acceptors, giving them $0.81 (6 rupees).

[d] Data for 1974.

[e] Service provided free to those unable to pay.

SOURCES: UNFPA, Policy Development Studies, No. 4; from [1]Nortman and Hofstatter, *Population and Family Planning Programs*, 1st through 9th editions, New York, Population Council, 1969-78 (unless otherwise noted). [2]J. C. Likimani and J. J. Russel, "Kenya" in *Country Profiles* (New York: Population Council, 1971). [3]A. Faundes and T. Luukkainen, "Health and Family Planning Services in the Chinese People's Republic," *Studies in Family Planning*, 3 (7):165-76.

Legal considerations

Legal considerations impinge directly on both the implementation of family planning programs and on other population-related efforts at the individual and national level.

Legal considerations apply to four major areas in the implementation of family planning programs:

1. dissemination of fertility planning information and provision of methods;
2. distribution of fertility planning methods—whether a prescription is required, which methods can be sold and where, and who can provide the services (included here are laws governing voluntary sterilization and induced abortion);
3. training requirements for personnel who will distribute contraceptives; and
4. who shall be eligible to obtain family planning advice and contraceptives.

Eligibility is especially relevant where both premarital and extramarital sexual activity contribute significantly to fertility rates (30).

Legislation that specifically affects women and their positions in the family is important because it affects the options available to them beyond their traditional roles as wives and mothers. In some countries, under Moslem law, a husband can terminate a marriage by simply declaring his intention to do so to his wife. In others, married women must be represented in judicial proceedings by their husbands, cannot work without their husband's permission, and often need the approval of their husbands before they can avail themselves of family planning services (30).

As pointed out in chapter 4, minimum age at marriage is a direct determinant of fertility change. Directly related to changes in age at marriage is the legal right of women to consent to a marriage, a right still not available in many countries. Child betrothal and subsequent early marriage also aggravate the low position of women, both because they lack free choice and must marry while young, and because husbands are traditionally 2 to 5 years older than their wives. Although many countries have set minimum ages for marriage, these laws are not always strictly enforced, and may not be sufficient to raise the status of women unless women are given opportunities beyond childbearing, such as education and paid employment.

Table 42.—Incentives Provided for Sterilization, by Country, 1975-77

Region and country	Cash payments to: User (U.S. dollars)	Provider	(dollars)	Fees charged to user (dollars)
Africa				
Botswana[a]	No cash payment			0.57
Tunisia (female)	11.65	2.35		Free
(male)		4.89		Free
Asia and Pacific				
Bangladesh (male)	2.10	2.10[f]		Free[b]
Hong Kong	No cash payment	—		20.00[d]
India	2.00-3.00	1.37		
		0.69[f]		Free
Indonesia	No cash payment	—		Free
Iran	No cash payment	—		Free
Malaysia	No cash payment	—		Free
Nepal	No cash payment	1.98		Free[c]
Pakistan (male)	1.50	1.50	0.50[f]	Free
(female)	2.00	2.00	0.50[f]	Free
Singapore	No cash payment	—		1.68
Sri Lanka	No cash payment	—		Free
South Korea	No cash payment	10.50		
		(for	male)	
		31.50		
		(for	female)	Free
		0.74[f]		
Thailand	No cash payment	—		2.50 (male)[e] 7.50 (female)

[a] Data for 1973-74.
[b] Data for 1974.
[c] Ten rupees in camps
[d] Free to those unable to pay.
[e] Free in rural areas.
[f] Cash payment given to diffuser.

SOURCE: UNFPA, *Policy Development Studies*, No. 4; D. Nortman and E. Hofstatter, *Population and Family Planning Programs*, 1st through 9th editions, New York, Population Council, 1969-78.

When family planning information is restricted, couples can remain unaware that they can limit their fertility. In Chad and several other countries, an old French law makes it a criminal offense to disseminate "contraceptive or antinationalist propaganda" through speeches in public or by placing in "public channels" books, written material, drawings, pictures, or posters. A major restriction on contraceptive distribution in LDCs is the requirement for a prescription. In Nigeria, where a prescription is required for oral contraceptives, there is one physician for each 40,000 people. (In some countries where prescriptions are required for the pill, the legal requirement is ignored and they are available on a nonprescription basis in the private sector (48).)

The status of induced abortion is always legislated. Even where induced abortion is legal, access to properly performed procedures can be impeded because restrictive legal provisions limit induced abortion to hospital settings or determine who may perform the procedure. If only physicians may legally perform first trimester abortions in countries where the number of physicians is limited, illegal abortions continue to be performed by untrained personnel.

In many LDCs, where marriage is nearly universal and takes place at a very young age, premarital sexual activity is negligible and laws that restrict access of supplies and/or information to married adults are not a problem. In countries where there is increasing demand from adolescents and single adults for contraceptive information and supplies, laws that restrict dissemination of family planning education in schools and other settings can interfere with the ability of these individuals to plan their fertility (30).

Do family planning programs make a difference?

Although there are exceptions, and the reasons for these exceptions are fairly well known, family programs do make a difference in reducing fertility. In 1978, Mauldin, Berelson, and Sykes undertook a major analysis to determine the relative contributions of program effort and social setting (level of socioeconomic development) to fertility declines in LDCs. Countries classified by both strength of family planning effort and level of socioeconomic development produced the groupings in table 43. The authors found that:

- In 94 LDCs during 1965-75 there were significant—some quite spectacular—fertility declines.
- The large countries—those with populations of 35 million or more—showed greater declines than did the smaller countries (although Bangladesh, Pakistan, and Nigeria are exceptions to this).
- The better-off countries, particularly those near the top in table 43, do better than the less well-off. But, on balance, family planning programs have a significant, independent effect over and above the effect of socioeconomic factors. Weak programs might as well not exist, so far as fertility reduction is concerned.
- The longer a family planning program has been in operation, the greater its effect (although several weak programs have existed for many years).
- Countries that have adopted population policies with demographic goals to reduce their rates of population growth have experienced much greater fertility declines than countries without family planning programs or countries whose programs were adopted for health reasons only.
- There is synergism between social setting and program effort. Countries that rank well on levels of socioeconomic variables and also make substantial program effort average much greater declines than do countries that have one or the other, and far greater declines than those with neither. A country that wants to reduce its fertility should seek a high degree of modernization (which of course all do, and find costly and difficult) and should adopt a substantial family planning program; for countries at or near the bottom of the socioeconomic scale, a special kind of determination—as found in India, Indonesia, and China—is required to implement a strong program effort (19).

The contributions of various factors to observed fertility declines can be separated. These contributions vary among countries, but on average, about 60 to 65 percent of the decline in fertility is attributable to social setting, 15 to 20 percent to the family planning effort of the population program, about 5 to 10 percent each to the age structure of the population and to program efforts to raise age at marriage, and about 15 to 25 percent to various unknown or unmeasured factors (table 44). Program effort thus accounts for 20 to 25 percent of the observed declines in fertility between 1965 and 1975.

McGreevey (18) added national income distribution to the index that Mauldin and Berelson used (the original index used GNP and GNP per capita), in an attempt to relate distribution of income to changes in fertility. He found that fertility is higher when poor people are much poorer relative to the rich. If the poor stay poor relative to the rich, fertility will decline more slowly than if the poor raise their relative income levels. He also added a government index which was associated with fertility decline, further confirming the Mauldin and Berelson finding that program effort may be an index for effective government in general.

Tsui and Bogue (42) extended the analysis by adding the total fertility rate at the time the family planning program was initiated. This additional variable serves as an index for a fertility decline which may or may not already be in process when the program begins. They found the greatest effect on the total fertility rate of 1975 to be associated first with this rate for 1968 (the index of whether a fertility decline may be in process); second, with family planning program effort; and third, with socioeconomic variables.

Another approach to assessing the impact of family planning programs is to first estimate the fertility change resulting from a particular change in contraceptive use and then use these estimates to determine the effect on fertility rates of a family planning program. Two countries for which these analyses have been carried out are Thailand and Colombia. Khoo and Park (16) estimated that some 200,000 births were probably averted by the Thailand program in

Table 43.—Crude Birth Rate Declines (in percents), by Social Setting and Program Effort: 94 LDCs, 1965-75

	Program effort								
	Strong (20 +)		Moderate (10-19)		Weak (0-9)		None		
Social setting	Country	Decline	Country	Decline	Country	Decline	Country	Decline	Total
High	Singapore	40%	Cuba	40%	Venezuela	11%	Korea, North	5%	
	Hong Kong	36	Chile	29	Brazil	10	Kuwait	5	
	Korea, South	32	Trinidad and Tobago	29	Mexico	9	Peru	2	
	Barbados	31	Colombia	25	Paraguay	6	Lebanon	2	
	Taiwan	30	Panama	22			Jordan	1	
	Mauritius	29					Libya	−1	
	Costa Rica	29							
	Fiji	22							
	Jamaica	21							
	Mean	30	Mean	29	Mean	9	Mean	3	19%
	Median	30	Median	29	Median	9.5	Median	2	22
Upper middle	China	24	Malaysia	26	Egypt	17	Mongolia	9	
			Tunisia	24	Turkey	16	Syria	4	
			Thailand	23	Honduras	7	Zambia	−2	
			Dominican Republic	21	Nicaragua	7	Congo	−2	
			Philippines	19	Zaire	6			
			Sri Lanka	18	Algeria	4			
			El Salvador	13	Guatemala	4			
			Iran	2	Morocco	2			
					Ghana	2			
					Ecuador	0			
					Iraq	0			
	Mean	24	Mean	18	Mean	6	Mean	2	10
	Median	24	Median	20	Median	4	Median	1	7
Lower middle	Vietnam, North	23	India	16	Papua New Guinea	5	Angola	4	
			Indonesia	13	Pakistan	1	Cameroon	3	
					Bolivia	1	Burma	3	
					Nigeria	1	Yemen, P.D.R. of	3	
					Kenya	0	Mozambique	2	
					Liberia	0	Khmer/ Kampuchea	2	
					Haiti	0	Ivory Coast	1	
					Uganda	−4	Senegal	0	
							Saudi Arabia	0	
							Vietnam, South	0	
							Madagascar	0	
							Lesotho	−4	
	Mean	23	Mean	14	Mean	1	Mean	1	3
	Median	23	Median	14.5	Median	0.5	Median	1.5	1
Low					Tanzania	5	Laos	5	
					Dahomey	3	Central African Republic	5	
					Bangladesh	2	Malawi	5	
					Sudan	0	Bhutan	3	
					Nepal	−1	Ethiopia	2	
					Mali	−1	Guinea	2	
					Afghanistan	−2	Chad	2	
							Togo	2	
							Upper Volta	1	
							Yemen	1	
							Niger	1	
							Burundi	1	
							Sierra Leone	0	
							Mauritania	0	
							Rwanda	0	
							Somalia	0	
					Mean	1	Mean	2	2
					Median	0	Median	1.5	1
Mean		29		21		4		2	9
Median		29		22		2		2	3

SOURCE: P. W. Mauldin, B. Berelson, Z. Sykes, "Conditions of Fertiliy Decline in Developing Countries, 1965-75," *Studies in Family Planning*, The Population Council, New York.

Table 44.—Sources of Fertility Decline in 94 LDCs During 1965-75

Factor	Age structure	Marital patterns	Marital fertility	Total
Social setting		25%	40-45% – 5% lactation = 35-40%	60-65%
Program effort:				
Family planning			10-15% + 5% spillover = 15-20%	15-20%
Legal sanctions and organized pressure		5-10%		5-10%
Consequence of earlier demographic trends	–5-10%			–5-10%
Unknown		5-10%	10-15%	15-25%
Total	–5-10%	35-45%	60-75%	Approximately 100%

SOURCE: P. W. Mauldin, B. Bereison, Z. Sykes, "Conditions of Fertiliy Decline in Developing Countries, 1965-75," *Studies in Family Planning*, 6(5):89-147, The Population Council, New York.

1975, and that 47 percent of the decline in fertility between 1968-69 and 1975 could be attributed to contraceptive protection provided by the program. Londoño and Bogue (17) found that about 56 percent of the fertility decline observed in Colombia from 1964-75 is attributable to organized family planning programs. In both of these cases the presence of family planning programs has clearly made a difference. The declines in birth rates would not have been as great if the programs had not made fertility planning services widely available.

Meeting future needs

At least 495 million couples (excluding China) will need contraception in 2000 (See table 51, ch. 9). If fertility were to fall to replacement levels over the short term, there would have to be a fourfold increase in contraceptive use at a minimum cost of $4.5 billion in 1980 dollars. Although there are regional differences, and countries within regions vary widely, several policy and program issues will be of concern for both the short and long term: 1) allocating resources; 2) establishing cost effective, self-supporting programs; 3) expanding availability of services to reach rural populations; 4) integrating family planning with other components of development; 5) strengthening program management; 6) increasing opportunities for women and raising their status; and 7) effectively using present and new technologies (45, 46).

Allocating resources

Although over 90 percent of the population of the developing world lives in countries that have formal policies in support of family planning, the financial commitment of their governments to family planning remains a small fraction of current health expenditures. In many countries, half or more of total government health budgets are devoted to a few urban hospitals and clinic based medical systems that do not reach the vast majority of the country's rural poor. Developing administrative systems to effectively provide fertility planning services to rural areas is one of the most important tasks for the next 10 to 20 years.

Establishing cost effective, self-supporting programs

Development of the private sector through social marketing techniques is crucial to the gradual self-financing of family planning programs in LDCs. These systems not only effectively reach rural areas where clinic coverage is weak and expensive to maintain, they also allow governments to put resources into medical support for MCH and for complications due to contraceptive use.

Countries that use multiple delivery systems—government health services, private physicians, private family planning clinics, commercial retail sales networks, and community-based distribution systems—can give couples the advantages of a comprehensive range of methods. Moreover, because many of the methods most easily distributed in community-based systems (condoms, pills, spermicides, etc.) need only backup medical services, a multiplicity of systems is also cost effective.

Expanding the availability of services to reach rural populations

Countries with strong programs where fertility is beginning to fall have been, for the most part, "easy," that is, these countries have relatively high levels of socioeconomic development, a fair degree of infrastructure, and trained personnel. The countries that will need support for the next 20 years are "difficult." These are countries that will require innovative approaches to reach rural populations and major efforts to train personnel and develop infrastructure capabilities and support for basic health services. In most, only small sectors of urban populations presently have real access to family planning services.

Rural couples who have sufficient resources and time can usually obtain some type of contraceptive method, but full access to family planning services—nearby presence of an outlet that offers services, information, and supplies, without major cost or inconvenience—remains out of reach of all but a few rural populations in LDCs.

Integrating family planning with other components of development

Although family planning programs have traditionally been linked in varying degrees with other health services, recent efforts have combined family planning with other community services (e.g., nutrition, nonformal education) and existing organizations (e.g., cooperatives, women's clubs). Because most of these projects require significant collaboration between agencies in allocation and control of resources, determination of priorities, and development of personnel policies, integration attempts often encounter administrative problems. Their experimental nature can also make them expensive to establish, particularly where few development services are in place. A decentralized approach that identifies and meets community level needs, focuses on primary health care, and capitalizes on local institutions appears to hold the most promise.

Strengthening program management

As the demand for services grows and programs expand in coming years, a crucial need will be for well-trained, highly skilled managers for family planning programs; experience has shown that expert managers can have tremendous impact on program performance. Senior management skills, which tend to be in short supply in LDCs, will be a major need, but substantial numbers of middle-level managers and supervisory personnel and a wide range of family planning workers will also be required. Governments will have to give high priority to management recruitment and training and to devising the new directions and flexible, innovative approaches that will be necessary to broaden services provision. Decentralized organizational structures designed to foster local decisionmaking and community participation will be needed to supplement today's largely centralized organizational patterns.

Increasing opportunities for women and raising their status

Women in many LDCs are restricted in their ownership of property, their ability to marry and divorce, their freedom of movement and employment, and their access to education and other resources. These social and economic constraints adversely affect their status and strengthen existing cultural pressures for women to define their lives solely in terms of their maternal roles. Improving the status of women through legal change, greater access to education and income-generating opportunities, and fuller participation in community life are key factors in redressing this imbalance. Greater ability to control decisions about their fertility will benefit women as spouses, mothers, and/or active members of the community, and enable them to make important contributions to the development process.

The needs of adolescent women in LDCs today are particularly acute. There are far more adolescents in the world at present than ever before in history because of high fertility in the recent past, and their potential fertility is far greater than that of their counterparts of previous centuries because better nutrition has lowered the age of menarche, making these adolescents capable of childbearing at much younger ages.

Their access to contraceptive services is frequently limited, especially in LDCs, and those who do use contraception tend to use ineffective methods. In Latin America, for example, most married teenagers have never used a contraceptive method even though they want to limit their fertiliy. Many use ineffective methods—some by choice—but often because of insufficient supplies or difficult access. Special approaches responsive to the needs of this vast group of young people will require major family planning program efforts in coming decades.

Effectively using present and new technologies

Because all of today's available fertility planning technologies have significant deficiencies and drawbacks, it will be a continuing challenge for family planning programs to use these technologies in ways that minimize their shortcomings. Ideally, programs offer a wide range of methods, but many family planning programs in LDCs have difficulty providing even four or five. The logistics of distribution, storage, and backup medical services can intervene to prevent the provision of some methods, as can cultural, religious, and legal restraints. With costs of supplies expected to increase at the same time that numbers of prospective users multiply rapidly, countries will have to carefully consider the costs and benefits of establishing their own production facilities. Couples will need reliable counseling to enable them to choose fertility planning technologies that are appropriate to their needs. Governments should thus give high priority to efforts to communicate accurate information on current methods and on new methods as they become available.

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Chapter 8

Research Needs

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Chapter 8

Research Needs

Abstract

Meeting the needs of couples to freely choose the number and spacing of their children and of nations to develop beneficial population policies will require extensive research. Areas of need range from fundamental knowledge of reproductive processes to development of service delivery systems to better understanding of the processes that give rise to population policies. Accurate, descriptive data are needed for current and continuing evaluation of population growth and change. Present information gaps include the causes of today's wide differences in mortality, the dimensions and consequences of international migration, and the specific impacts of rapid population growth. Despite the consensus that current fertility planning technologies fall short of ideals of safety, effectiveness, acceptability, and ease of use, there is little support for basic research to develop new or improved methods for planning fertility or to correct and prevent infertility. Specific R&D efforts are needed on male contraceptive methods and new approaches to female contraception; improved barrier and periodic abstinence methods, and better methods of nonsurgical sterilization. Evaluation research on the safety and side effects of various methods is a further need, as is research aimed at improving the contraceptive R&D process itself.

Factors that influence acceptance of fertility planning technologies and the relationships between culture- and age-specific factors and these technologies require investigation, and one of the greatest needs is for a sound theoretical framework on the factors that determine fertility. Such factors include men's and women's differing roles, beliefs, and attitudes, and the influence of political and administrative systems. How various institutional arrangements influence family planning programs and how different political processes lead to population policies require clarification. Improved formulation of population policy requires the results of broad-based research on the effects of population growth, which in turn requires intensified coordination and improvement of data collection efforts. Systematic analysis of family planning "success stories" could be productive in developing predictive capability and designing better programs. Evaluation of the impact of past and present policies and programs (both those with specific family planning objectives and those with indirect impact on population growth such as education and nutrition programs) has been identified as a critical need. Finally, there is a need to better understand what research is most needed by policymakers and how it can most effectively be brought to bear on policy. Because of the inadequacies of current technologies and the acknowledged increase in need for them in the years ahead, basic and developmental research is clearly needed. But because of the long lead times in the development of new contraceptive methods, more effective use of current technologies is central to meeting less developed countries (LDCs) population goals. Research that will lead to better utilization of these technologies is thus of key importance in the immediate future.

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Introduction

A "research need" is an area of basic or applied research where additional effort would be likely to result in information or products of value to policymakers, providers, or consumers. The focus of this chapter is on research that will improve the ability of couples to choose the number and spacing of their children and nations to develop beneficial population policies. Research needs in the population field are many. They range from fundamental knowledge of reproductive processes to characterization and development of effective service delivery systems to better understanding of the political processes that give rise to population policies. The breadth and number of research needs in this field arise from the complexity and number of factors influencing population growth and the fact that current understanding of them is limited.

Basic data and theory

Verifiable reporting of the levels, trends, and differentials of the three components of population growth—fertility, mortality, and migration—requires careful collection of data. Accurate, descriptive data are needed for countries, regions, and various socioeconomic groups so that the magnitude of population growth and the factors influencing it can be assessed.

Existing studies, for example, show wide differences in mortality among different social classes in LDCs. The causes and magnitude of these differences need clarification so that health services can be designed for maximum effect.

Both the amount and impacts of internal migration require study, as does the relationship between internal migration and the larger development contexts of particular countries. Each country's overall development goals lead to an associated political structure and basic political philosophy. These determine both the country's desire to control internal migration and the means it is prepared to use. While this general statement can be made, quantitative characterization of the forces that determine internal migration cannot presently be accomplished.

Better information is needed about the dimensions and consequences of international migration and the roles played by migrant workers in various countries. Because international migration is an increasingly emotional and potentially explosive problem, it is important to improve the factual base so that myth can be separated from reality.

The World Fertility Survey now under way is providing more accurate basic data on differing levels of fertility, but the need for better understanding of the determinants of fertility is urgent, as pointed out in chapter 7.

Specific information is also needed on the consequences of population growth for all countries of the world. The recently completed Global 2000 study clearly demonstrates that inadequate, inaccurate, and conflicting data and assumptions make prediction of energy, water, food, and other resource availability uncertain. The lack of adequate data on the United States makes program evaluation difficult and the assessment of primary impacts problematic. As the paucity of data in LDCs is far greater, it is even more difficult for these countries to develop useful resource projections. It is also difficult to evaluate the implications for more developed countries (MDCs) of projections based on such limited data. Knowledge of the relationships among population size, resources, and technology is needed for informed planning to accommodate population growth and to provide the basis for framing and implementing policies and programs aimed at modifying this growth.

New and better models of the factors that influence population growth are needed. Because traditional explanations cannot fully account for the major declines in fertility that have recently occurred in some countries, better explanatory variables and theories are needed. Most existing explanatory models fail to consider the variables that have proved increasingly important in the past 25 years. Such variables include political systems, public policies, and methods of program implementation.

Fertility planning technologies

Basic biomedical research is fundamental to the development of new or improved methods for regulating fertility and correcting or preventing infertility. Better understanding of reproductive biology will permit identification of new points of intervention that may lead to safer, more effective and/or easier-to-use methods than those now available. However, as a National Science Foundation (NSF) report (10) points out, "mixed feelings about the value of pure science have recurred as a theme throughout U.S. history." A major reason is that the relationship between basic research and useful technology is often unclear. The report provides 26 examples of NSF-funded research over a 30-year period in which the applications were not anticipated when the research began.

Another factor in the lack of support for basic research is the long time lag between fundamental work and its application. This is especially true in pharmacologic technologies where the need to meet Food and Drug Administration requirements adds to the time between research and application. As in the case of the contraceptive pill, 20 years may pass before the fruits of research are realized. Additional deterrents are the high costs of field trials and product liability suits (see ch. 5). These factors make basic research in reproductive processes aimed at developing a new method of contraception increasingly unattractive.

Yet there is general agreement that current fertility planning technology falls short of meeting ideals of safety, effectiveness, acceptability, and ease of use. In LDCs, family planning is practiced by fewer than one-fifth of couples of reproductive age (excluding China). Discontinuation rates are high: after 2 years, nearly two-thirds of oral contraceptive users and half of those using IUDs have stopped using these methods. Sociocultural influences and distribution problems contribute to these high discontinuation rates, but drawbacks associated with the methods themselves are unquestionably significant. Although the likelihood of an ideal contraceptive is remote because the characteristics of that ideal differ among cultures and during different stages in the reproductive lifespan, new or improved methods can certainly be produced by undertaking the appropriate research. A variety of improved technologies, including those for treatment of infertility, would provide couples with more varied, effective, and safer choices to meet their changing needs for contraception.

While development of new technology in this field is often time-consuming and expensive, this is not always true. Some highly effective instruments and procedures have been developed for relatively low expenditures of time and dollars. Examples include minilap sterilization, syringe equipment for menstrual regulation and induced abortion, and cautery equipment for vasectomy. Such new developments generally depend less on new knowledge than on improvements in technology, which may arise from other fields (e.g., the fiber optics used in minilap sterilization). An opportunity for similar rapid, relatively low-cost development in the near term may lie in contraceptive delivery systems such as implants, injections, and drug-releasing IUDs and vaginal rings, and in foolproof methods for detecting the time of ovulation.

The opportunities for basic research are broad. They range from characterization of the structure of molecules fundamental to the reproductive process (such as gonadotropins) to the physiological level (such as the relationship between sperm development and testicular support cells). The 1976 "Greep Report" (3) lists more than 230 gaps in knowledge of reproductive processes; most of these still exist.

R&D needs in specific areas of family planning technology include:

- *Development of better male contraceptives.* Prospective methods include those to suppress sperm production and to intercept sperm maturation, and simplified sterilization procedures.
- *Further development of barrier methods.* Highly effective methods that would eliminate the need for coitus-related application or for privacy during application would be welcomed not only in LDCs but by the growing number of MDC women concerned about the side effects of most nonbarrier methods. Better materials, product designs, and modes of administration could result from further research in this area.
- *Improved methods of periodic coital abstinence.* The development of means to reliably identify the fertile and infertile phases of the menstrual cycle could, by sharply increasing use-effectiveness, both increase the use of such methods and improve their low continuation rates.
- *New approaches to female contraception.* Areas of promise include LRF analogs, immunizing antigens, vaginal steroid rings, and post-coital methods such as menses inducers.
- *Better methods of nonsurgical sterilization.* The World Health Organization (WHO) (13) has noted that the demand for sterilization by surgery cannot be met in some LDCs because of lack of trained personnel, operating rooms, and anesthetics.
- *Better methods of preventing and correcting infertility.*

Many causes of unwanted infertility could be eliminated by improved understanding of reproductive processes.

Evaluation research, as opposed to research on new contraceptive methods, is also needed. Of primary concern are the safety and side effects of current contraceptive technologies. Specific interest lies in:

- risks for cardiovascular diseases and other diseases associated with use of oral contraceptives in different populations and under different dosages of different hormones;
- the effect of disease states such as anemia, malaria, and schistosomiasis on absorption, effectiveness, and safety of different fertility planning methods;
- the hypothesized carcinogenic effects of spermicides and therefore the need for safer spermicides to be used with various methods;
- better understanding of how genetic differences, nutrition, and body characteristics alter method safety, effectiveness, and side effects;
- the safety of contraceptive implants and injections;
- whether induced abortion under medically supervised conditions is associated with adverse outcomes in subsequent pregnancies;
- methods to counteract the blood loss associated with nonprogesterone-releasing IUDs which can result in iron deficiency;
- the long-term effects of contraceptive methods, such as the risk of cancer; and
- medical bases for high discontinuation rates.

Finally, there is a need for research aimed at improving the R&D process itself. Better understanding of species differences between animals and humans, for example, would improve testing for side effects, safety, and effectiveness of new methods of fertility planning.

Factors influencing acceptance of fertility planning technologies

LDCs are homogeneous only in their designation as "less developed countries." Intercountry and intracountry differences in economic and social structure, religious beliefs, public policies, and personal values and attitudes range through a broad spectrum and affect the relative acceptability of different fertility planning technologies. Appropriate technologies also vary with age, reproductive status, and frequency of sexual activity. The consequences of an unplanned birth are very different for a woman with no children than they are for a mother of five, and for single and married women. Thus, the relative weight placed on the criterion of effectiveness, for instance, in selecting among various methods will vary for women in these different circumstances. Other criteria vary in relative weight in similar fashion.

Therefore, a fundamental research need is the relationship between culture-specific (11) and age-specific factors and various fertility planning technologies. Theoretically, it should be possible to develop physiological and psychological self-tests for use by an individual—or as guides for family planning workers—to help a man or woman select the contraceptive method most appropriate to his or her needs and values at a given point in time. Information on age-specific factors as they affect acceptability would also be of great value to policymakers in deciding which drugs or devices to include in family planning programs.

One of the greatest needs is for development of a sound theoretical framework describing the factors that determine fertility. Information to develop such a framework requires research on patterns of social organization and their influence on the reproductive and economic decisions of individuals. The economic value of children and institutional factors governing fertility incentives need elucidation.

Among cultural factors, a very important area of investigation is women's beliefs and attitudes and how these influence their practice of family planning. These relationships require investigation on both physiological and psychosocial levels. At the physiological level, understanding attitudes toward changes in menstrual patterns is particularly important because these changes are most frequently cited as reasons for discontinuance of such contraceptives as orals and IUDs. At the same time, women who state that they will not tolerate changes in their menstrual cycles continue to use contraceptive methods that cause such changes. Much remains to be learned about what menstruation means to women of different cultures, whether and how their beliefs can be modified, and how decisions are made in selecting among contraceptive methods.

On the psychosocial level, the relationships between contraceptive practice and the following areas need investigation:

- the role of women in a given class and/or culture;
- women's autonomy for decisionmaking; and
- women's perception of themselves, their bodies, and childbearing.

Male beliefs about different fertility planning methods and about the responsibility of men for their use also require clarification. WHO studies suggest that there is demand for male contraceptives in different cultures, but the very low usage rates and the difficulty encountered by investigators in recruiting male volunteers for clinical studies raise questions about male acceptance of both existing and new contraceptive technologies.

Decisionmaking with regard to the adoption of family planning is influenced not only by the feelings and beliefs of the individual man and woman in a couple but by considerations of that couple as a family. Achieved family size and desired family size, the role and status of children within a culture, male-female communication, and participation of various family members in decisions on the number and spacing of births are all little-understood factors which influence acceptance and use of family planning and the methods specific to achieving desired family size. The same can be said of the relationships between individual men and women or between couples and their peers.

To make choices among various fertility planning technologies, individuals must be aware of the methods that exist and the benefits and consequences of each. How best to communicate such information both within a given mode (e.g., different forms of package inserts) and across modes (e.g., the media v. physicians v. family planning workers) requires further research. The role of pharmacists, physicians, and others who provide information on family planning methods also needs attention.

Many of the conditions that determine acceptance of contraceptive technologies do not lie in the users themselves but in the political and administrative systems that distribute the technologies. Elites make decisions on what methods to use, how the distribution shall be organized, who shall be the distributors and educators, what price to charge, what the message will be, and how the methods will be packaged. Yet, the managing elite and the delivery systems themselves have rarely been the subject of systematic research. This type of program research is a major gap on both theoretical and empirical grounds and may pay high dividends in the short run.

Finally, some research on the determinants of fertility has been aimed at increasing the use of family planning services, thus enabling parents to have the family size they want. But this is only one of two fundamental social objectives in fertility policy. The other is to balance the numbers of children individual couples want for themselves with the number the whole society thinks best. Research on how this second objective is accomplished and how it influences fertility is needed.

Population policy

The relative contributions of availability of fertility planning methods and of general socioeconomic development to reducing population growth have been a subject of considerable controversy, with strong advocates on both sides. Each undoubtedly contributes and the relative contribution in a particular case will vary with culture-specific factors. Further research to bolster either position might better be directed toward broader based research on the complex interaction of the many factors that influence population growth. Methodologies are available for study of these interactions, and data collection efforts need to be designed so that these can be used. Data on social, economic, and political variables are often collected in different ways at different times by different groups. Coordination of data collection efforts would also facilitate disaggregated analysis at the subnational level, which is necessary to better design family planning programs. The comparative research within and across countries that is needed to improve predictive ability—which approach to family planning is likely to work best under what conditions—would be facilitated as well. Critical analysis of individual variables is also needed. Assistance to LDCs in experimental design and use of the new methodologies would be beneficial.

A systematic analysis of "success stories" —areas where dramatic reductions in population growth have been achieved—could be productive. Through careful analysis, factors that have led to success might be identified and ranked in probable importance for further evaluation. The objective of such work would be to improve predictive capability with regard to the factors likely to lead to effective programs in different contexts.

The need for viewing family planning activities in a broader context was recognized by Congress in 1978 in passage of an amendment (sec. 104d) to the Foreign Assistance Act of 1961. Section 104d requires that all assistance programs, not just those specifically directed at population, be evaluated for their impact on population growth.

Policymakers attending the workshops held by the International Review Group to identify social science research needs for the 1980's also identified evaluation of past and present policies and programs for their impact on population as one of their most critical needs (8). Evaluation of both those policies and programs with specific family planning objectives and those expected to have indirect impact, such as in the areas of education and nutrition, was called for. The lack of existing knowledge, however, about how specific factors interact to influence population growth makes this an as yet impossible task and points up the need for research to make such efforts achievable.

Research is needed both on the effect of general policies and programs and on specific interventions. For example, how effective is a program which promotes breastfeeding as a method of limiting fertility likely to be? What is its cost? What are its nutritional and other effects? How does such a program compare to one promoting later ages at marriage?

The situational aspect of specific interventions should not be neglected. A finding of WHO acceptability research is that not enough is known about the application of various fertility planning methods in specific situations. Though some might not consider how IUDs are inserted in women of an Indian village as a subject for research, information on similar situation-specific applications is considered a significant need in many LDCs.

How various institutional arrangements influence family planning programs in particular countries should be further studied. Whether, how, and under what conditions family planning should be combined with health care or other socioeconomic programs are the kinds of questions on which further information is needed. Such information would permit development of guidelines that administrators could use in designing family planning programs.

Finally, there is a need to better understand the political processes that lead to population policies and the relationship of research to policy formation. Although it is often difficult to show that a specific piece of research has had an influence on policy, a number of cases where the relationship is clear have been documented. In a review of such work (5), evidence is summarized that clearly shows that research findings have influenced policy in four areas:

- *development of antinatalist population policies*—definitive evidence comes from Colombia, Thailand, and Taiwan;
- *service delivery*—research has supported the use of paramedical or nonmedical personnel to provide fertility planning services and information traditionally supplied by physicians. Research findings have also had a major influence on the implementation of hospital postpartum programs and on selection of particular contraceptive methods such as the pill and the IUD;
- *development of population growth targets*—research findings have been used to formulate programs and estimate budgets necessary to meet specific population growth goals; and
- *migration and redistribution of population*—a good example of the influence of research on policy in these areas comes from Colombia (5).

In a fifth area, that of population education, it is too early to evaluate the many recently implemented specific programs providing education on population-related topics in LDC schools, but a number of these programs include comparisons of the effectiveness of various teaching methods and the relationship between educational level and material presented. This information is of obvious value to policymakers.

Research, by showing the high mortality rates associated with abortions performed under inadequate medical conditions in Chile and other Latin American countries, was of considerable significance in the establishment of family planning programs in these countries: "programs were often justified, and sometimes evaluated, in terms of their effectiveness in preventing induced abortion" (5). Such research has also influenced policy on the legal status of induced abortion.

Much remains to be learned, however, about the research most needed by policymakers, how such research should be done, and especially how it can be brought to bear on policy. As Miro and Potter (7) point out, it is widely assumed that "if research succeeds in identifying the relationship between demographic variables and social, economic, and cultural indicators, then a tool will have been obtained for use in policy decisions. But that is as far as it goes.

Policy relevance is not attached to a thorough analysis of how, in fact, government policies eventuate and the decisionmaking processes that are involved." They argue that such information would provide a firmer basis for predicting how different research results might be used and which individuals and government agencies should be kept aware of new developments in the field of population.

The relative importance of different kinds of research

The preceding sections cover three kinds of research that might be described as basic, developmental, and utilization research. Basic research includes studies of reproductive processes and fundamental studies in apparently unrelated areas (such as in materials science which may eventually lead to improved contraceptive devices). Also included are development of basic demographic data and theory, and development of explanatory models and new measurement techniques.

Developmental research links knowledge and practice and is particularly applicable to such important aspects of new or improved contraceptive technologies as dosage levels, mode and frequency of administration, and safety. Regulatory requirements that must be met add to the expense and risks involved in developmental research.

Utilization research, as applied to fertility planning technologies, is the study of cultural, economic, and political factors that impede or promote use of technically safe, effective technologies. The objective of utilization research is to ensure that the technology is distributed and administered in ways that are consistent with the cultural, economic, and political values of a given society. Despite its importance, utilization research is often inadequately emphasized in the process of developing and distributing fertility planning technologies.

Research on delivery systems, institutional arrangements, and evaluation of program effectiveness is included in utilization research. Also included is development of techniques that can be used to increase use of family planning methods, usually termed operations or management research. Although utilization research could be considered market research, it is broader than what usually falls under that rubric; hence the term "utilization research."

Each of these three categories of research serves different purposes. Because of the inadequacies of current fertility planning technologies and the acknowledged increase in need for them in the years ahead, basic and developmental research to develop improved methods is clearly needed. But because of the long lead times in development of new methods, current technologies will have to be used more effectively if population goals are to be met in the next 20 years. Utilization research will thus be of key importance in the immediate future.

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Chapter 9

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Chapter 9

Financial Support for LDC Population Programs

Abstract

In 1980, total resources committed to population and family planning programs in less developed countries (LDCs) amounted to about $1 billion; $450 million came from more developed countries (MDCs) governments and international agencies, $100 million from private organizations, and $450 million from LDCs themselves (excluding China). The largest providers of international population assistance today are the U.S. Government through the Agency for International Development (AID), the United Nations Fund for Population Activities (UNFPA), the International Planned Parenthood Federation (IPPF), and the World Bank. The United States provided over 50 percent of all population assistance prior to 1973, but this share has since leveled off to about 40 percent, where it has remained for the last 4 years. Several of the Scandinavian countries, Japan, and West Germany have increased their population assistance donations by 30 to 60 percent over the past few years; as of the end of fiscal year 1981 the U.S. contribution had risen only 6½ percent since 1978. Inflation has also cut the purchasing power of AID's population assistance efforts to below that of the peak year of 1972 ($121 million). AID obligates international population assistance to LDCs through four major channels: 1) bilaterally to LDC governments; 2) multilaterally to UNFPA; 3) indirectly through private U.S.-based intermediary organizations; and 4) through contributions to the private multilateral IPPF. The U.S. contribution to the World Bank is authorized separately by Congress; the Bank then administers population projects as components of its total development program.

About 75 percent of international population assistance from all sources is provided for family planning services, including contraceptive supplies. The remaining 25 percent supports information and education activities, policy development, data collection, institutions and training, and research efforts. In 1979, Asia received the largest share of population assistance (60 percent); followed by Latin America (20 percent), Africa (12 percent) and the Middle East (8 percent). International population assistance has had diverse impacts over the last two decades. More people are aware of the problems associated with rapid population growth; data of better quality are available to enable governments to formulate policy; countries are becoming increasingly self sufficient and taking greater financial and administrative responsibility for their family planning programs as they mature. The strongest impact has been on fertility rates, which have begun to decline and are declining more rapidly in countries with strong family planning programs. Despite this recent decline in fertility rates, high fertility persists in many LDCs. Their populations also have enormous momentum for growth because of their youthful age structures. In the next 20 years there will be a 65-percent increase in the need for contraception as increasing numbers of couples enter their childbearing years. Excluding China, in the year 2000 some 495 million couples of reproductive age (compared with 300 million in 1980) will need contraceptive protection if population growth is to stabilize. Using conservative present-day family planning cost estimates as a base ($15 per couple) the cost of achieving replacement fertility today would be $4.5 billion annually. The cost of this achievement in 2000, in 1980 constant dollars, would rise to $7.4 billion. Under this formula, the amount rises to $10.7 billion when China's childbearing-age population is added.

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Introduction

International assistance for population and family planning programs in LDCs today comes from three major sources: private organizations, national governments, and intergovernmental agencies. Most of these agencies took on this role during the 1960's, when the implications of rapid population growth emerged as a worldwide concern. During the 1970's, these agencies, working in a generally cooperative way, assumed different functions in the complex and expanding field of population assistance. They operate in different ways both because the LDCs and regions are at varying stages of their demographic transition to lower birth and death rates, and because the complexity and sensitivity of population issues require a mix of programs and agencies to enable each country to have access to one or more sources that meet their needs.

Origins of population assistance from the United States

Awareness of the magnitude of population growth in LDCs grew gradually during the late 1950's and early 1960's. Statements from the countries themselves heightened this awareness, as did the activities of such organizations as the Population Council and the United Nations (U.N.). The U.N. published its first *Demographic Yearbook* in 1949 and its first series of population projections in 1952, which forecast a 1980 world population of 3.6 billion. This total was revised upward in 1957 to 4.2 billion.

India adopted a national family planning policy in 1951 and Pakistan included demographic policy and family planning activities in its national development plan in 1955. Demographer Ansley Coale and economist Edgar Hoover built a population growth model in 1958 which demonstrated that family planning expenditures would, over various intervals, increase per capita income to a greater degree than any other type of government investment. Although this model was developed for India, its message to other LDCs was clear: a reduced rate of population growth would always mean additional funds for capital investment because there would be fewer dependents and smaller expenditures for consumption and social needs. The actions taken by India and Pakistan, and the activities of private organizations and the U.N., heightened public recognition of the hazards of rapid population growth.

Until the mid-1960's, private agencies played the major role in international population assistance. These agencies were of two types: activist citizen organizations like the International Planned Parenthood Federation (IPPF), established in 1952, and the Pathfinder Fund, established in the 1930's, in which business leaders and community workers merged to promote public recognition of population problems and provide family planning services directly to those who wanted them; and professional scientific organizations like the Population Council, also established in 1952, which focused on specialized demographic and biomedical research and then on technical assistance as requested. Private donors—individual philanthropists and such major foundations as Ford and Rockefeller—provided financial support for these scientifically oriented programs. Princeton, North Carolina, Michigan, and Johns Hopkins Universities, with this help, were able to develop training programs for population/family planning specialists.

Although private agencies had been seeking Government support for more than a decade, several factors combined in the 1960's to stimulate official concern and to prompt the first U.S. public support for population assistance. The 1960 round of censuses showed high rates of population growth in LDCs, especially in Asia. The governments of Pakistan and India had by the 1960's begun to ask the United States and other MDCs for help. The U.N. Population Commission and the U.N. Economic Commission for Asia and the Far East brought population issues to international attention.

Within the U.S. Government, such expert advisory groups as the Draper Committee (in 1959) recommended that the U.S. provide assistance for population planning at the request of LDCs. The election of John F. Kennedy in 1960 as the first Catholic President of the United States helped defuse religious issues and brought to power an administration that viewed population growth as a national policy matter.

The food crisis that developed in South Asia in the mid-1960's also spurred U.S. Government concern. Members of Congress had initiated the Food for Peace Program (Public Law 480) in 1954 and were following international food developments closely. The news that food production in many LDCs was failing to keep pace with population growth was highlighted in House and Senate hearings. As a result, the Congress took the initiative in 1963 and again in 1966 and 1967 to provide specific legislative authority for the United States to assist LDCs with their population growth problems.

The AID population assistance program, first created by Congress as a part of a concerted War on Hunger, and then as an important element of humanitarian and social development, grew from a $5 million effort in 1965 to one of $190 million in 1981. From the beginning, the U.S. program has made extensive use of private organizations. Influenced by both the important role of private voluntary agencies in other assistance efforts and by the fact that until the mid-1970's many LDC governments were not yet ready to adopt bilateral assistance for official population programs, AID and other donors support a network of private agencies that provide family planning services, training, information, and education; demographic and policy data; and public health research.

Origins of population assistance from the U.N. and from MDCs other than the United States

The government of Sweden, the first to give assistance to an LDC for family planning, supported pilot projects in Sri Lanka in 1958 and Pakistan in 1961. The United Kingdom followed with small-scale assistance programs in India and Pakistan in 1964. Denmark made its first official grant in 1966 in support of a pilot study to test the suitability of a Danish IUD for India's national family planning program. The Netherlands offered bilateral support to a family planning project in Kenya in 1968. The Federal Republic of Germany and Finland followed in 1969 with support to multilateral programs and Canada, Japan, and Norway joined in the effort in the early 1970's.

International agencies had meanwhile begun to respond to LDC needs for population assistance. Although the impetus for response to international population problems came from a number of U.N. agencies, a viable U.N. unit with a specific mandate in the field of population did not exist until 1969 when the U.N. Fund for Population Activities (UNFPA) became a separate unit within the U.N. Development Programme (UNDP). Following the unanimous General Assembly Resolution in 1966, a trust fund was established to become UNFPA, and operational activities began 3 years later.

Within the U.N. system different offices and agencies have different responsibilities for the execution of population programs: the Statistical Office gathers statistics and the Population Division conducts research on population issues and makes demographic projections; the World

Health Organization provides technical expertise for assistance to maternal and child health and family planning services; UNESCO deals with population education and communications; UNDP provides general development assistance on request but relies on UNFPA for population expertise.

Most U.N. agencies depend on contributions assessed from member nations on a population/income formula and are reluctant to start new programs without additional funds. Their governing bodies and staff were at first apprehensive about the political implications of a program that might be controversial. Established first as a trust fund of the Secretary-General and entirely dependent on voluntary contributions from interested governments and on the technical expertise of other agencies, UNFPA came into being with a minimal mandate in a field where responsibilities were fragmented and bureaucratic rivalries strong.

UNFPA uses a broader definition of population planning than does AID's Office of Population. UNFPA programs, often in conjunction with LDC health ministries, focus on migration, mortality reduction, and maternal and child health (MCH) activities in addition to fertility planning, while the AID Office of Population, as legislated by Congress, is primarily concerned with family planning activities. Separate accounts within AID handle health activities.

The World Bank initiated a population program in 1969. The Bank, which has more development resources than any other international agency, deals with high level finance and planning officials in LDCs. Population planners hoped this influence would be used within LDC governments to provide more support for population programs, but banking officials have remained skeptical of such programs; less than 1 percent of Bank resources have been directed toward population projects in recent years. About 20 population projects totaling $400 million have been initiated since 1969 through the Bank's International Development Association (IDA) and International Bank for Reconstruction and Development (IBRD), and the Bank is now working to integrate population, health, and nutrition projects to provide a broader operating base.

Support for population activities

Channels of assistance

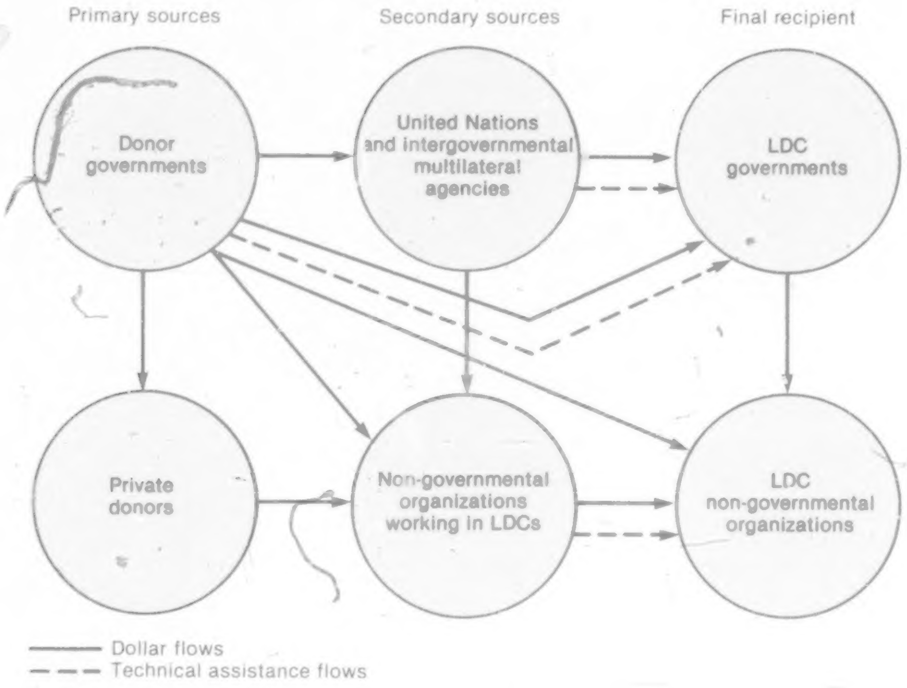
Donor governments are the principal sources of population assistance. Most smaller donors contribute only to UNFPA or to other U.N. programs, but larger donors such as the United States, the Scandinavian countries, Germany, Japan, Britain, and Canada have contributed in three ways: 1) to private intermediaries or nongovernmental organizations (NGOs), i.e., IPPF and the Population Council; 2) directly to LDC governments through bilateral loans and grants; and 3) to UNFPA. UNFPA contributes in turn to LDC governments and also provides a small amount of support for private intermediaries and for global activities, such as conferences (see fig. 25).

Private sector donors contribute primarily to NGOs such as IPPF, the Population Council, the Pathfinder Fund, and Family Planning International Assistance (FPIA). These in turn provide both funds and advisory personnel to local organizations within LDCs. Some international private agencies, like IPPF and the Population Council, also make expert advisory personnel available to assist LDC governments or to organize U.N. or global programs such as the 1974 World Population Conference in Bucharest and the 1981 conference in Jakarta on Family Planning in the 1980's.

Kinds of assistance

Kinds of population assistance, although not strictly comparable, can be grouped under six functional headings (see table 45): 1) *family planning services*—purchasing and distributing contraceptive commodities, and providing support

Figure 25.—Channels and Directions of International Population Funding and Technical Assistance


Primary sources
Secondary sources
Final recipient
Donor governments
United Nations and intergovernmental multilateral agencies
LDC governments
Private donors
Non-governmental organizations working in LDCs
LDC non-governmental organizations
Dollar flows
Technical assistance flows

SOURCE: Office of Technology Assessment.

Table 45.—Composite of Kinds of Assistance Provided by Major Assistance Agencies

Office of Technology Assessment composite	AID	UNFPA	IPPF	World Bank
Family planning services	Family planning services, commodities	Family planning programs, services and training	Medical, health services, commodities	Delivery of services, management, construction
Information, education, and communication (IEC)	Information, education, communication	Communication education	Information, communication	Information, education, communication, motivation
Institutions and training	Institution building, training	Population dynamics,	Training	Training
Research and evaluation	Biomedical and operations research	Population determinants Multisectoral activities	Evaluation	Research and evaluation
Policy development	Policy development, social science research	Formulation and implementation	Special projects	—
Data collection	Demography	Basic population data collection	—	—

SOURCES: Annual reports of each agency, AID Congressional Presentation, 1980.

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for family planning program management and operations, personnel, and equipment (AID, UNFPA, IPPF, and World Bank all expend close to half or more of their population funds for family planning services, and the Bank includes clinic construction in this category); 2) *information, education, and communication (IEC)*—informing or educating the public about family planning, contraceptive mehtods, and the implications of rapid population growth; 3) *institutions and training*—teaching and training of clinic personnel, midwives, and family planning practitioners; 4) *research and evaluation*—sponsoring biomedical and social science research activities, family planning program evaluation, and operations research; 5) *policy development*—conducting leadership awareness activities in the government and private sector in LDCs (AID also includes research on fertility determinants and women's roles); and 6) *data collection*—gathering, analyzing, and disseminating relevant population information through censuses and surveys.

Roles of assistance agencies

The private agencies (Population Council, IPPF, FPIA, AVS, etc.) are major innovators in service delivery, training, and research. For example, IPPF, FPIA, and others initiated community-based distribution (CBD) of contraceptives—usually condoms and pills—by networks of local community leaders. The Ford Foundation initiated contraceptive sales activities in LDCs through retail storekeepers. Private agencies and universities have trained and equipped physicians in newly simplified techniques of female sterilization, and were the first to establish collaborative international research networks to pool data and evaluate new contraceptive technologies in a pattern now being expanded by WHO. They have tested new computer techniques for storing and retrieving population data and presenting these data visually to government leaders, and have experimented with women's programs to develop women's management skills and spread awareness and knowledge of family planning. In countries where population policies are in flux, private family planning associations have provided a measure of continuity.

The role of international agencies is necessarily different, and less experimental. UNFPA, for example, works with other U.N. agencies and national governments to fund efforts to build national capacity to formulate and implement population policies and programs. UNFPA has served three main population assistance functions that supplement and complement U.S. Government efforts:

1. As a multilateral agency, UNFPA has been able to stimulate substantial additional funding for population assistance. Of the more than 85 governments that have contributed to UNFPA, fewer than 10 have separately staffed bilateral population assistance programs. Most would probably have made little contribution to population programs had they not had the opportunity either to contribute directly to UNFPA or to support multilateral-bilateral projects combining national funds and UNFPA-U.N. specialized agency monitoring and expertise.
2. The various international agencies, including UNFPA and the World Bank, have helped to define rapid population growth as a global concern, an obstacle to economic development, and a problem in need of high level national attention. Their efforts underscore the fact that population assistance is a cooperative response to an international need. Whether the immediate issue is rapid urbanization or high levels of unemployment, UNFPA has called government attention to the underlying demographic causes and made assistance available to address the problem at hand. World Bank officials can articulate the adverse economic impacts of rapid population growth while working with the planning and finance ministries that set government budgets.
3. International agencies can mobilize technical assistance to help LDCs help each other. Even though national programs may suffer temporarily if skilled people leave to join these agencies, these experts can bring

their specialized experience to bear on similar problems in other LDCs, where it is likely to carry more weight than advice from MDC governments that have not faced comparable population problems. Through this process of mutual support, LDCs can move toward greater self sufficiency.

Among these channels of population assistance, AID has played a multiple role. As one of the first and still the largest of government assistance programs, AID has provided part of the basic strategy for population programs. AID's strategy is based on the established public health principle of availability—making information, supplies, and services readily available so that individuals who choose to plan their fertility can do so conveniently. As a result, AID has been the principal supplier of contraceptives, purchasing in bulk from U.S. firms at low competitive prices. (For example, AID now pays $0.15 for a cycle of oral contraceptives that would otherwise wholesale in an LDC for about $3.50.) Through the use of intermediary agencies, AID has encouraged CBD of contraceptives and other cost effective approaches for the delivery of family planning information and supplies to rural populations that lack access to clinic-based services. In addition, AID has been responsible for many major improvements and innovations in the field of fertility planning technology.

The AID program has been both a catalyst and a stimulus to other agencies in developing such projects as the World Fertility Survey, which is also supported by UNFPA and other governments. AID's efforts have encouraged other governments and agencies to improve their programs, and universities, private agencies, LDC governments, and the World Bank to undertake more intensive efforts in program implementation.

U.S. share in international assistance

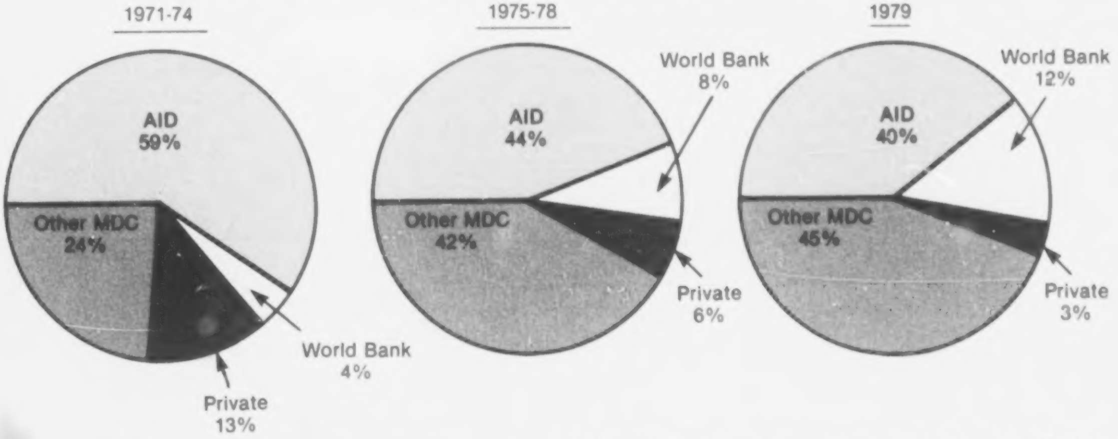
Less than 2 percent of official development assistance from all MDC donors is currently allocated to population activities, which represents a small decline since 1970. The United States provides just under 4 percent of its global development assistance for population activities. In 1980, total resources committed to population and family planning programs in LDCs amounted to about $1 billion. LDC contributions accounted for about $450 million in 1980, excluding China; roughly $550 million originated externally as international population assistance. (See app. A for China expenditures.)

MDC governments over the last decade have consistently generated more than 80 percent of all international population assistance; the remainder has originated with the World Bank and private sources. Among MDC donor countries, the United States, through AID, continues to be the largest contributor of population assistance. The United States provided 50 percent or more of all primary source assistance until 1973, when the U.S. share of this funding decreased and the portion provided by other sources increased (see fig. 26). By the mid-1970's, the U.S. share leveled off to about 40 percent, and has remained at this level for the last 4 years. This decrease is largely due to increased contributions from other MDCs. Several of the Scandinavian countries, Japan, and West Germany have increased their funding over the past few years by 30 to 60 percent. United States funding for population assistance has increased only 6½ percent since 1978 after having increased by 40 percent between 1975 and 1978 (see table 46). The impact of inflation has cut today's funding level—in constant dollars—to below that of the peak year of 1972. In that year Congress provided AID with a budget of $121 million. Inflation has cut the value of AID's 1981 appropriation of $190 million to about $100 million, and the 1982 appropriation of $211 million is $28 million below the amount required to maintain the 1972 level (see fig. 27).

Components of U.S. population assistance

AID obligates its population assistance through four channels: 1) direct bilateral from AID to LDC governments; 2) indirect bilateral through U.S.-based private organizations to NGOs in LDCs; 3) intergovernmental multilateral (e.g., UNFPA), in which MDC donations are

Figure 26.—Primary Sources of International Population Assistance



SOURCE: *UNFPA Report on Population Assistance, 1979*—Table 1. Percentages refer to expenditure data with some exceptions: 1) AID data prior to 1979 reflect commitments; and 2) World Bank percentages reflect loan credit agreements committed in a particular year, but disbursed over several years of project duration.

Table 46.—AID Annual Budgets for Population Assistance, 1975-81 (in millions)

Year	Budget	Percent increase over previous year
1975	$106.0	—
1976	119.0	11%
1977	145.4	18
1978	177.6	18
1979	184.9	4
1980	185.0	0
1981	190.0	3

NOTE: Figures and percentages reflect actual dollar figures, not allowing for inflation.

SOURCES: *UNFPA Report on Population Assistance*, 1979, table 1, for years 1975-79. AID table 500 for years 1980, 1981. Figures represent commitments.

pooled and redistributed to LDC governments and NGOs; and 4) private multilateral (IPPF), in which donor funds are pooled and redistributed to IPPF affiliates in LDCs (see fig. 28). The United States also contributes to the World Bank, but this separate authorization from Congress is not channeled through AID.

DIRECT BILATERAL

In calendar year 1979, the latest year for which complete data are available, about $48 million (26 percent of the AID population budget) went directly to 33 LDC governments: 11 each in Africa and Latin America, 8 in Asia, and 3 in the Middle East. In 1979, the largest recipients of U.S. bilateral aid for population activities were:

	Millions of dollars
Indonesia	$11.4
Bangladesh	4.0
Philippines	2.4
Tunisia	1.8
Thailand	1.7
Nepal	1.7

INDIRECT BILATERAL

In 1979, some $90 million (52 percent of the AID population budget) went to private intermediary organizations. Eighty-five percent of this assistance was channeled through 14 agencies (see table 47), which provide substantial amounts of technical assistance to countries where bilateral assistance is not always appropriate. U.S.-based NGOs provided technical assistance to 64 LDCs in 1979: 22 in Africa, 19 in Latin America, 14 in Asia, and 9 in the Middle East.

INTERGOVERNMENTAL MULTILATERAL

In 1979, the United States contributed about $30 million (16 percent of the AID population budget) to UNFPA. This constituted 27 percent of UNFPA's budget. UNFPA grants went to 116 LDCs in 1979: 37 in Africa, 31 in Latin America, 28 in Asia, and 20 in the Middle East/Mediterra-

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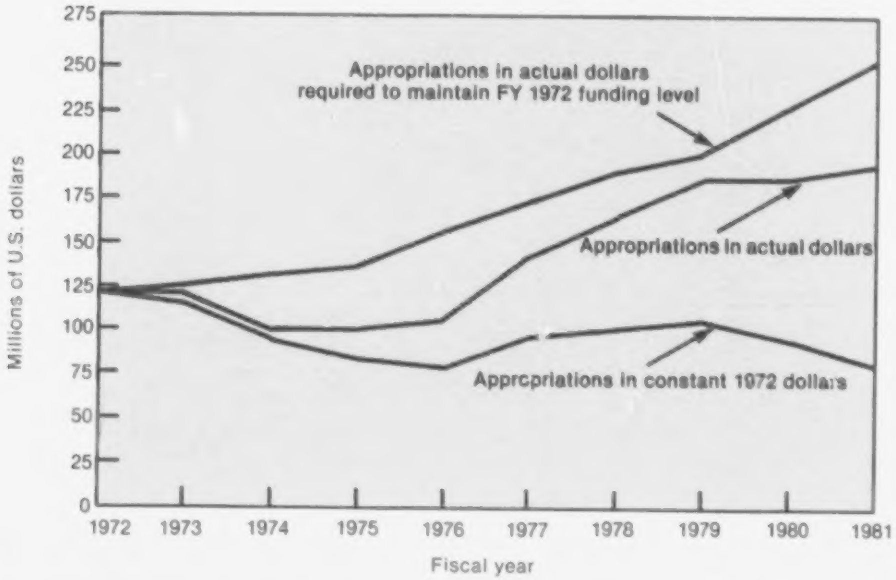
Figure 27.—U.S. Population Assistance in Actual and Constant Dollars

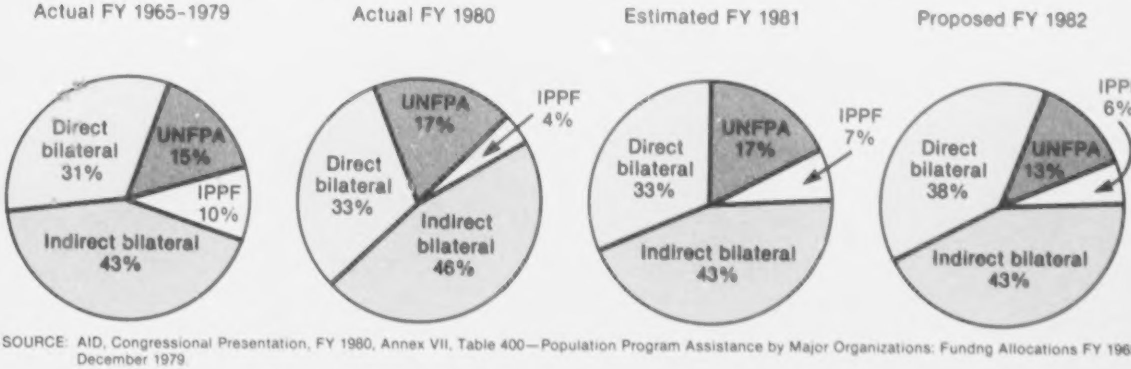
Population assistance fiscal years 1972-81 in actual and constant (1972) dollars



NOTE: Actual dollar levels exclude operating expenses except when these were combined with program funds.

SOURCE: Agency for International Development.

Figure 28.—Distribution of AID Population Funds: 1965-79, 1980, 1981, 1982 (proposed)



SOURCE: AID, Congressional Presentation, FY 1980, Annex VII, Table 400—Population Program Assistance by Major Organizations: Fundng Allocations FY 1965-80; December 1979.

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Table 47.—Principal Organizations Administering AID Population Funds, 1979

Intermediary organization	Estimated expenditures from AID for fiscal year 1979 (in millions)
Family Planning International Assistance (FPIA)	$14.0[a]
Association for Voluntary Sterilization (AVS)	7.7[a]
Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO)	7.2
Pathfinder Fund[b]	6.7[a]
International Statistical Institute (World Fertility Survey)	5.0
International Fertility Research Program (IFRP)	4.2
Development Associates	3.0
Westinghouse Health Systems	2.9
University of North Carolina	2.2
Johns Hopkins University	1.6
Population Council	1.6
Battelle Memorial Institute	1.5
Program for Applied Research on Fertility Regulation (PARFR)	1.1
East-West Center	1.0

[a] Refers to actual expenditures.
[b] Also receives substantial funding from private sources.

SOURCE: AID Congressional presentation, 1980; Personal communications with Family Planning International Assistance, Association for Voluntary Sterilization and Pathfinder Fund.

nean. Those countries receiving the largest grants from UNFPA in 1979 were:

	Millions of dollars
India	$17.0
Vietnam	4.9
Bangladesh	4.5
Thailand	3.0
Egypt	2.4

In 1980, the U.S. share of contributions to UNFPA fell to 26 percent of its budget where it remained during 1981. This marks the lowest point of declining U.S. input to this agency (see fig. 29).

PRIVATE MULTILATERAL (IPPF)

The remaining $22 million (12 percent of the 1979 AID population budget) was channeled through IPPF.[*] This represents 28 percent of IPPF's total operating budget and, as in the case of UNFPA, is a proportional decline of U.S. input since 1970 (see fig. 30). IPPF provided grants to 88 private family planning affiliates in LDCs in 1979: 21 in Africa, 32 in Latin America, 20 in Asia, and 15 in the Middle East.

The countries receiving the largest grants from IPPF during calendar year 1979 were:

	Millions of dollars
Brazil	$3.4
Colombia	2.9
India	2.0
Mexico	1.4
Republic of Korea	1.2

International assistance to LDCs

The quantification of dollar flows from MDC governments and international agencies to specific LDCs cannot be precise because:

- funds that pass through a variety of agencies are often commingled, making identification of initial donors difficult;
- interpretations vary as to what international population assistance is, as opposed to, for example, MCH assistance;
- different accounting methods, fiscal years, and exchange rates are used; and
- commitments span several years and are often reprogrammed through continuing evaluation and review processes, making identification of given-year expenditures exact.

The relative proportions of all external population assistance to each region were fairly constant from 1977 through 1979, with Asia receiving the greatest share (see fig. 31). Excluding funds for regional, interregional, and global purposes, country-specific dollar expenditures increased from $208 million in 1977, to $232 million in 1978, to $280 million in 1979 (see table A-3, app. A) for total amount of external assistance to each LDC).

AFRICA

Total average international assistance to Africa during 1977-79 for all population activities remained at about $0.09 per capita per year. Almost half of this aid came from UNFPA. Among African countries, Kenya and Tanzania received the larges population assistance grants,

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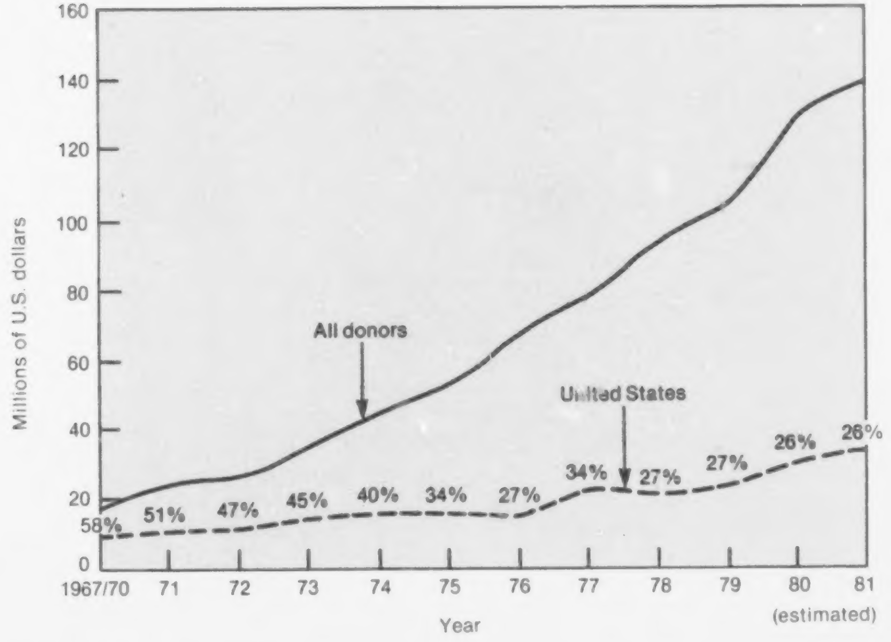
[*] Note: This was not a representative year for the IPPF appropriation from AID. The figures for 1978 and 1980 were about $10 million less.

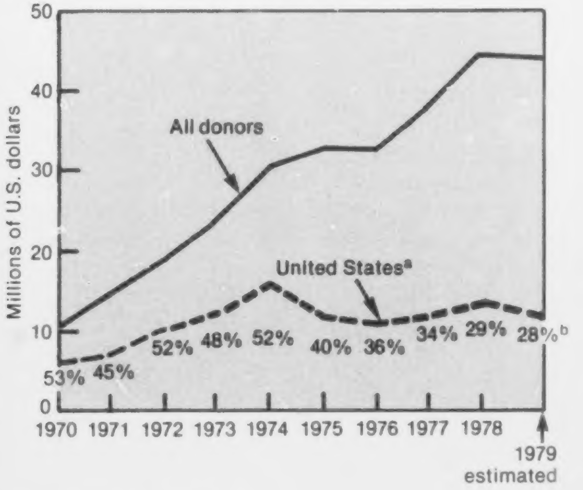
Figure 29.—Contributions to UNFPA by the United States and All Donors



SOURCE: UNFPA Financial Data Sheet, prepared by S. Mousky, February 1981.

Figure 30.—Contributions to IPPF by the United States and All Donors

International Planned Parenthood Federation income and expenditures 1970-79



[a] Includes in-kind commodities.
[b] Funding brought forward to 1980 not included (approx. $10 million).

SOURCE: IPPF: London, 1980

averaging $0.59 and $0.22 per capita per year, respectively, over the 3-year period. West African countries received less: Nigeria, $0.03 per capita; Niger, $0.04; Upper Volta, $0.01; and Cameroon, $0.04.

African countries either do not generally recognize rapid population growth as a problem or are at early stages of program development. Population assistance to Africa, relative to other regions, places greater emphasis on demographic data collection, IEC, and family planning in the context of maternal and child health. Nevertheless, family planning services and commodities accounted for 58 percent of all assistance to Africa in 1979 (see fig. 32).

ASIA

Per capita population assistance (excluding China) rose from $0.09 in 1977 and 1978 to $0.12 in 1979. Because Asia contains 8 of the 13 most populous countries in the world, and because Asian countries have the longest history

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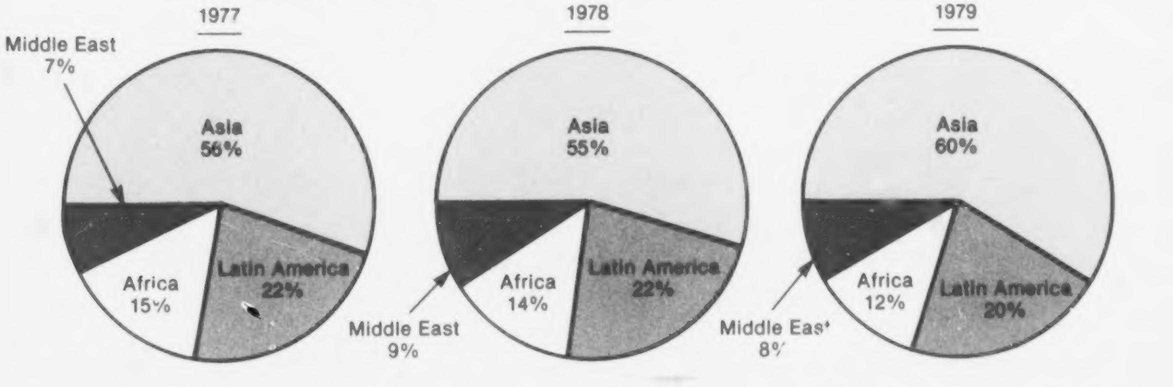
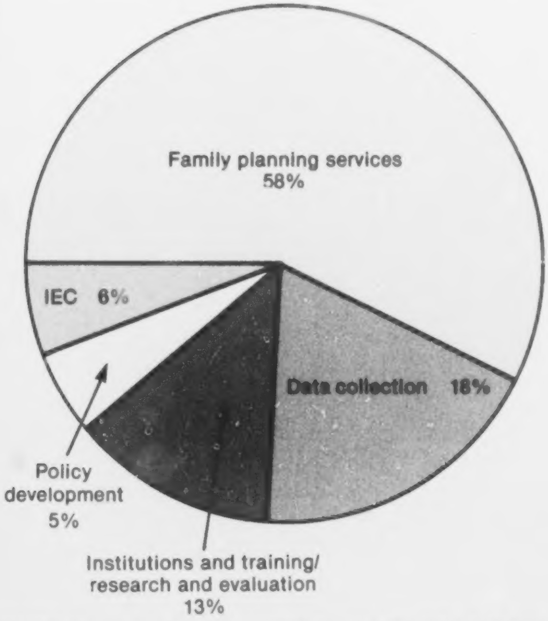
Figure 31.—Regional Distribution of All External Population Assistance, 1977-79



NOTE: Percentages include funds channeled to specific LDCs; funds for regional, interregional, and global activities designated for particular regions are also included.

SOURCE: UNFPA Table 2—Assistance to Population Programs by Country and Region by Major Donors, 1977-79.

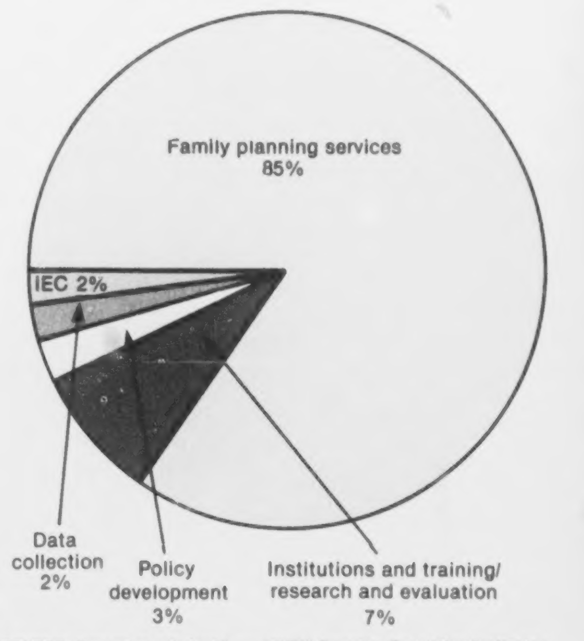
Figure 32.—Kinds of Population Assistance Provided to Africa, 1979



SOURCE: Percentages derived from: *UNFPA Report on Population Assistance, 1979*—Table 3—Assistance to Population Programs by Country and Region and Major Population Sector.

of government-sponsored programs, more funds flow into this region. In 1979, 90 percent of all international population assistance to Asia came from U.N. agencies and direct bilateral donors. Bangladesh received $0.49 per capita, Thailand $0.38, and the Philippines $0.28. A large portion of assistance to Asia has been earmarked for expansion of services and purchase of commodities (see fig. 33).

Figure 33.—Kinds of Population Assistance Provided to Asia, 1979



SOURCE: Percentages derived from: *UNFPA Report on Population Assistance, 1979*—Table 3—Assistance to Population Programs by Country and Region and Major Population Sector.

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LATIN AMERICA

Latin American countries rely extensively on intermediaries for population assistance. In 1979, IPPF and the Ford and Rockefeller Foundations provided 36 percent of population assistance to Latin America. NGOs provided 53 percent of the $9.7 million contribution to Brazil, 44 percent of the $11.2 million contribution to Colombia, and 65 percent of the $8.3 million contribution to Mexico. Although Latin American countries received less total population assistance than Asia in 1979, per capita averages were higher (about $0.19); relative proportions of assistance were similar, with most funds spent on family planning services (see fig. 34).

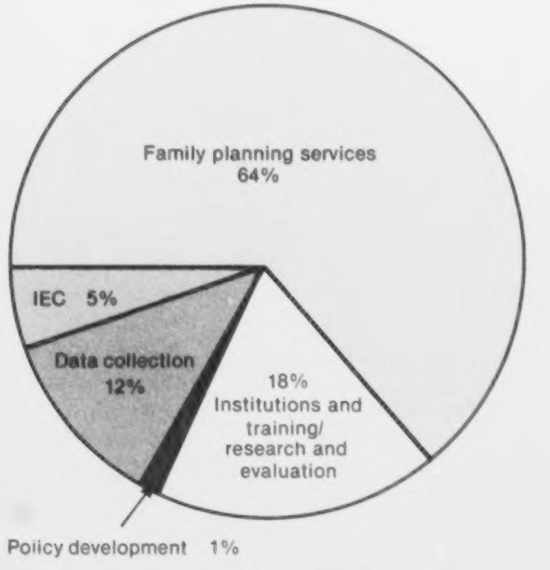
MIDDLE EAST/MEDITERRANEAN

Middle Eastern and Mediterranean LDCs received the smallest share of international population assistance of all major regions over the last few years. Although total country-specific assistance in this region grew 62 percent between 1977 and 1979, from $14.4 million to $23.3 million, the relative share of total world population assistance remained at only 8 percent. Total per capita population assistance in 1979 amounted to about $0.12. UNFPA contributed more than half of this assistance through large grants to Egypt, Jordan, and Tunisia. Egypt also obtained substantial World Bank support during the late 1970's and 1980-81. Tunisia received one of the largest per capita population assistance donations in 1979 ($0.78), principally from AID and UNFPA. Like Africa, the Middle Eastern/Mediterranean region is at a comparatively young stage of policy and program development, and data collection for increased demographic awareness is a major focus of population activities (see fig. 35).

THE 13 MOST POPULOUS LDCs

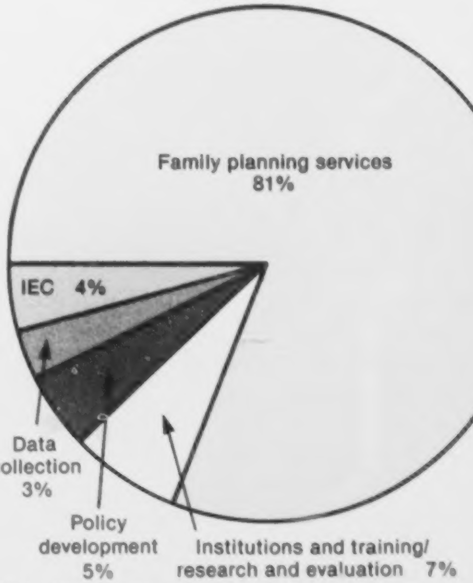
External population assistance trend data and per capita estimates for 1977-79 to the 13 most populous LDCs are shown in table 48 (for complete list of countries see table A-3, app. A, ch. 9). Thirty-nine percent of all external population assistance in 1979 went to these countries,

Figure 34.—Kinds of Population Assistance Provided to Latin America, 1979



SOURCE: Percentages derived from: *UNFPA Report on Population Assistance, 1979*—Table 3—Assistance to Population Programs by Country and Region and Major Population Sector.

Figure 35.—Kinds of Population Assistance Provided to Middle Eastern/Mediterranean Regions, 1979



SOURCE: Percentages derived from: *UNFPA Report on Population Assistance, 1979*—Table 3—Assistance to Population Programs by Country and Region and Major Population Sector.

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Table 48.—Total International Population Assistance Flows to 13 Most Populous LDCs, 1977-79, (in millions of dollars)

Country	1977	1978	1979	Cents received per capita 1979
China	$ 0	$ 0+	$ 0.4	0+
India	19.5	35.6	36.[illegible]	5
Indonesia	42.4	23.8	24.2	16
Brazil	5.0	9.0	9.7	8
Bangladesh	18.0	20.7	43.8	49
Pakistan	4.2	2.3	3.1	4
Nigeria	1.4	1.4	1.9	2
Mexico	5.3	7.6	8.3	12
Vietnam	1.2	0.7	5.4	10
Philippines	4.3	19.0	14.5	28
Thailand	7.3	11.7	18.2	38
Turkey	1.2	1.5	2.1	5
Egypt	2.2	7.3	6.6	16

SOURCES: UNFPA Reports on Population Assistance, 1977, 1978, 1979-table 2. Per capita figures derived from medium variant population projections for 1979 from *United Nations: World Population Trends and Prospects by Country, 1950-2000: Summary of the 1978 Assessment*, New York, 1979.

which comprise 75 percent of the world's population. If China's population is excluded from the total count, the proportion becomes more equal: 39 percent of population assistance goes to 46 percent of the LDC population.

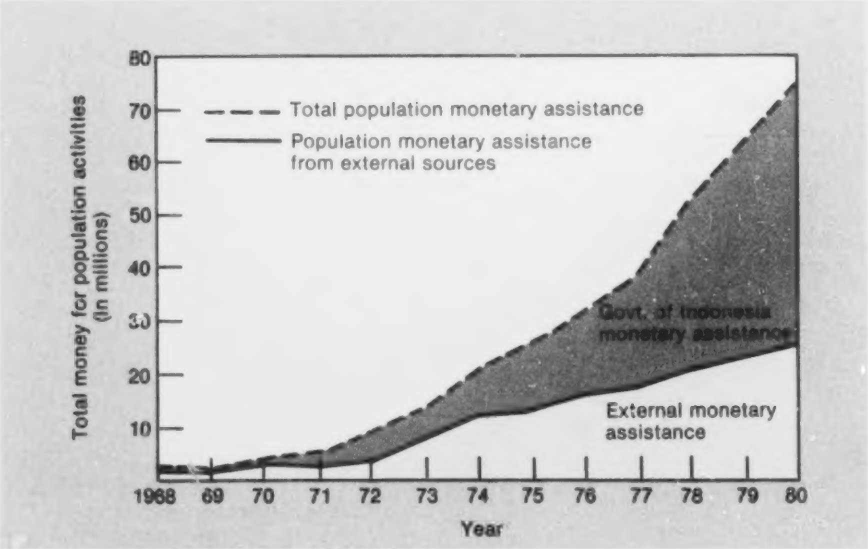
LDC support for population activities

Of the $1.0 billion spent for population activities in 1979, LDCs contributed $450 million. The LDC commitment is thus a crucial component of support for population programs.

Although data are not available for all countries, there is evidence that some LDCs assume funding and operational responsibilities in proportion to the length of time the program has been in operation. In Indonesia, trend data illustrate this growing government commitment as the family planning program has matured (see fig. 36). In 1968, 96 percent of Indonesia's total budget came from external assistance; by 1980, this share had fallen to 35 percent. Some of this current assistance is for raw materials for local production of contraceptives, as the government's goal is self-reliance in the production of orals by 1985-90.

Many populous LDCs are contributing more than 50 percent of the funds needed for their population programs. Table 49 shows 16 such countries for which data are available. Of the 13 most populous countries, China, Bangladesh, In-

Figure 36.—Trends in Monetary Population Support in Indonesia



SOURCE: AID's Role in Indonesian Family Planning; Program Evaluation Report No. 2, app. table 3. Compiled from AID estimates from various sources.

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Table 49.—Degree of Support Provided by Selected LDCs for Population Activities/Number of Years Government and Private Agency Sponsored Services Available

Country	Local dollars for population activities (thousands)	As a percent of all population funding	Years family planning services available	
			Government	Private
Category I: Countries providing more than 50 percent of all resources (1980)				
Bangladesh	$ 22,000	54	21	28
India	175,000	79	29	32
Indonesia	49,700	65	13	24
Malaysia	8,000	78	14	23
Nepal	4,145	54	15	23
Philippines	23,500	69	11	16
South Korea	16,188	84	20	20
Thailand	10,914	60	14	26
Costa Rica	2,496	58	13	15
El Salvador	4,030	62	13	18
Jamaica	1,386	56	14	24
Mexico	48,207	81	8	16
Panama	2,582	88	12	15
Mauritius	800	69	9	24
Senegal	2,428	77	—	—
Morocco	8,000	73	15	11
Category II: Countries providing less than 50 percent of all resources (1980)				
Colombia	2,100	33	14	16
Dominican Republic	317	11	13	15
Honduras	410	11	15	20
Paraguay	96	13	8	15
Botswana	108	6	9	—
Ghana	1,235	43	11	14
Kenya	2,000	16	14	20
Swaziland	130	24	—	—
Tanzania	1,152	46	—	—
Egypt	11,283	38	15	28
Tunisia	1,000	10	15	13

—Data unavailable.

NOTE: Countries included in this table are those that have local family planning expenditure data available.

SOURCE: AID, *Memorandum on Cost Implications of Population Stabilization*, table 5; March 17, 1981 (for dollar figures). L. Corsa and D. Oakley, *Population Planning*, table 7.2, Initiation of National Family Planning Programs, pp. 217-219 (for length of family planning program data).

dia, Indonesia, the Philippines, Thailand, and Mexico contributed more than 50 percent to their population programs (data are unavailable for the other most populous countries). Nine of twelve countries in which private family planning associations have provided services for 20 or more years are now more than 50 percent self-sufficient.

Impacts of population assistance

Population assistance has had diverse impacts. More people are now aware of the problems associated with rapid population growth. Government officials, scientists, and informed lay people from LDCs and MDCs are working together to develop new contraceptive methods. Many women of reproductive age in many LDCs have at least heard of family planning even though some may not fully understand what it means or may not yet have convenient access to contraceptive methods. Laparoscopic surgical techniques incorporating use of plastic rings and clips for voluntary female sterilization (developed with population funds) make it possible for paramedical personnel to carry out this procedure in many countries. More data of better quality are available to enable governments to formulate policy, set demographic goals, and monitor program effectiveness. Each of the three decennial census rounds from the 1960's through the present has been characterized by substantial improvements in data collection techniques and data processing and analysis capabilities in LDCs. The World Fertility Survey (WFS) and Contraceptive Prevalence Surveys are providing rich information on fertility trends and differentials, levels of contraceptive knowledge and use, and program evaluation data. Operations research projects are testing innovative approaches to the delivery of family planning information and methods. Social marketing programs have put contraceptives on the road to being self financing in some LDCs. Most importantly, mass media campaigns have made the topic of family planning and discussion of contraceptive methods public and acceptable. *Above all, fertility rates have begun to decline and are declining rapidly in countries with strong family planning programs.*

The awareness of rapid population growth as a problem is now worldwide. At the international Conference of Parliamentarians in Colombo, Sri Lanka, in 1979, delegates from 58 nations agreed that international population assistance from donor countries should be targeted to reach $1.0 billion by 1984. The climate for discussion of population-related issues has changed dramatically in the past decade. The topic of the Second International Conference on Voluntary Sterilization held in Geneva in 1973 was so sensitive that WHO refused to participate. Much conference time was spent trying to develop a euphemism for the term "voluntary sterilization"; "surgical contraception" was the favored candidate. Although the spector of coercion arose during India's 1976 vasectomy campaign, changing attitudes were evident at the fourth such conference, held in Seoul in 1979, where more than 400 delegates from 75 countries shared information on voluntary sterilization techniques and delivery methods developed with population assistance funds.

Better data derived from the decennial censuses make determination of population growth rates, bases for economic forecasting, and analysis of population distribution changes much more reliable. UNFPA has taken a leading role in providing technical assistance to LDCs to improve the substance and quality of their collection and analysis of census data. These data in turn are supplemented and complemented with data derived from surveys on particular topics.

WFS, for example, has provided an extensive data base on fertility trends and factors influencing fertility in LDCs, and is making the first comparable data available from 50 LDCs. Early results from about 20 WFS countries indicate that:

1. *Levels of knowledge of contraception are high.* Over 90 percent of married women in many countries and at least 75 percent in most other countries know at least one method of contraception. In a few countries where family planning programs have only recently been implemented, 25 to 33 percent know at least one method.
2. *There is a large unsatisfied demand for family planning.* Among women who say they want no more children, about half are not currently using contraception. This proportion reaches 90 percent on the Indian subcontinent, where contraceptive practice is low. As contraceptive use increases, desired family size decreases, because when women realize they can avoid unwanted pregnancies, they are likely to change their perceptions of ideal family size.
3. *A major reason why women who want no more children aren't using contraception is that contraceptives are not always accessible.* Women cite a number of reasons for not using contraception, including fear of side effects, opposition of husband, or weak motivation. Recent analyses, however, have indicated that contraceptive use in some LDCs would increase markedly with the addition of more family planning outlets, a wider choice of methods, and a reduction in traveling time to these outlets.

4. *Women acknowledge that they have more children than they want.* In 12 of the 15 countries where women were asked whether their most recent birth was wanted or unwanted, more than 30 percent said the birth was unwanted.
5. *Rural and uneducated women do practice contraception.* More than 40 percent of rural currently married women aged 35 to 39 have used contraception in 13 of the 20 countries for which data are available. Levels of use are generally lower among rural and uneducated women but these differences are reduced if contraceptives are available at the village level at low cost.

These analyses and others nearing completion provide information previously unavailable to scientists and government officials in LDCs, and have documented trends that many scientists only suspected. These surveys have also left a legacy of trained people in LDCs who are now better able to carry out demographic research.

Funding for the surveys has been cooperative. The largest portions have been contributed by AID and UNFPA, but Great Britain's Overseas Development Ministry (ODM) has also contributed, and LDCs, on average, bear about one-third of the in-country survey costs.

Photo credit: World Bank

Home visits by field workers provide health and family planning information in rural Kenya

The International Fertility Research Program (IFRP) funded primarily by AID and UNFPA has, since 1971, conducted clinical trials of new fertility planning methods in 200 centers in some 50 countries, primarily in Latin America and Asia. IFRP has also established national fertility research programs that now have the capability to conduct their own research in Bangladesh, Colombia, India, Indonesia, Sri Lanka, and the Sudan. This program is continuing its training function and testing postpartum IUDs, techniques for nonsurgical sterilization, and barrier methods and conducting comparative trials on side effects of different oral contraceptives.

The Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) has, since 1973, trained physicians from 70 LDCs in maternal and infant care, infertility, high-risk pregnancy, and voluntary sterilization. Followup studies indicate that each participant in this program has trained an average of 12 to 14 other LDC physicians upon return to his or her country.

The impacts of population assistance can be measured both in terms of successful projects such as these that cover many countries, and in terms of successes in individual countries where a number of projects and often multiple donors have participated in national efforts.

Indonesia's success story has become a model for other population efforts in Asia (see app. B). Begun in earnest in 1968 with the establishment of the National Family Planning Board, the country uses Village Contraceptive Distribution Centers and the help of local volunteers to recruit and supply family planning users. There are now 25,000 village distribution centers in Indonesia—one for each village on the main islands of Java and Bali. In 5 years, average completed family size dropped by one-third in Bali and one-fifth in Java. In parts of Bali, about 75 percent of married women are using contraceptives—a rate that approaches those of China and MDCs. This downturn in fertility rates is especially significant because Indonesia is characterized by a relatively low level of socioeconomic development that is often associated with low success in family planning program efforts: per capita income is only $180 per year, infant mortality rates are nearly 150 per 1,000 live births, and literacy among adult females is only 50 percent. AID has been the major donor, with contributions from the World Bank and UNFPA.

Mexico's national family planning program, announced in 1972, became fully operational in 1974. Between 1976 and 1978, total fertility rates fell from 6.15 to 5.18--a reduction of one child per woman. Between 1973 and 1978, contraceptive use increased from 13 to 42 percent of all married women. Assistance has been provided primarily through private and international organizations.

Thailand has been highly innovative in its family planning program and is moving rapidly toward self-sufficiency. It was the first LDC to experiment with innovative ways to distribute oral contraceptives in rural villages. Forty-seven percent of the fertility decline from 1968 to 1975 has been attributed to organized family planning programs (19). Contraceptive use increased from 33 to 53 percent between 1975 and 1978. A major component of this increase has been the number of women electing voluntary sterilization. The Thai program has received external assistance from AID and UNFPA.

Do family planning programs make a difference or would fertility rates fall anyway? Demographers Mauldin and Berelson showed that in LDCs with strong family planning programs, fertility declined an average of 30 percent between 1965 and 1975 (some declines were as high as 50 percent)(11). This is in contrast to declines of 15 to 30 percent in LDCs with moderate programs and 1 to 8 percent in those with weak or nonexistent programs. There is synergism between effective programs and the level of development of a country, but, on balance, family planning programs have a significant impact over and above the country's development level (for details, see ch. 7).

In some countries, population assistance has been available and programs have been in operation for a number of years but fertility has not declined appreciably; Pakistan and Kenya are examples. Renewed efforts are now under way to solve persistent problems of infrastructure and give women opportunities beyond childbearing.

Is assistance for family planning cost effective relative to other interventions to reduce population growth rates? Factors such as increased female education, reductions in infant mortality, and rises in per capita incomes for the poor are linked to fertility decline. These interventions are highly justified in both humane and economic terms. Nevertheless, LDC government economists and planners faced with tight budgets must choose those interventions that are both humane and cost effective. A combined governmental effort to modify fertility by providing family planning services and raising women's educational levels has multiple potential benefits: fertility is likely to decline because services are available, educated women are likely to have fewer children, and smaller family sizes mean smaller numbers of children who will need to be educated in the future. But an effort to modify fertility levels solely by raising women's educational levels, although the education of women is unquestionably an urgent need in LDCs, is likely to be extremely costly. Simmons (20) estimates that such an educational program would be seven times more costly than an effort focused primarily on the provision of family planning services. The relative costs of other single interventions to modify fertility, each of which, aside from its impact on fertility, stands as a critical need in LDCs, vary widely. Intervening to modify infant mortality in this context is estimated to cost up to 36 times more than a family planning effort; the cost of intervening to raise per capita income is estimated to be 138 times greater.

Future needs

Five major parameters define the future needs and priorities of U.S. population assistance to LDCs:

1. the types of assistance appropriate to various countries in light of their national policies and priorities, and the needs of their particular population programs;
2. the number of couples of reproductive age in LDCs now and in 2000;
3. the estimated costs of population programs that include provision of family planning services and supplies for an increasing percentage for these couples;
4. the countries or regions where population growth will be concentrated in the next two decades; and
5. political and other considerations governing the distribution of U.S. population assistance.

Types of assistance appropriate to various countries and regions

Some LDCs are at relatively advanced stages of population program development, while others have taken only preliminary steps toward organized programs. These wide variations in program development are likely to persist during the next two decades. Countries at early stages are more likely to emphasize policy development, IEC efforts, legal changes that affect women's status, infrastructure development, training, and clinic construction. These actions tend to be expensive, and are unlikely to result in early, measurable changes in fertility and contraceptive use rates. Although population support in countries with longstanding population programs is likely to be more cost effective because infrastructures are more highly developed, diverse, well-run service delivery systems are in place, and a wide range of contraceptive methods has been made available, comprehensive estimates of program costs cannot be made. Some generalizations, however, can be made by region:

The number of Asian couples who will need family planning services is immense, but almost all governments in this region have recognized the problem and initiated family planning programs, often with specific demographic targets. Until satisfactory local manufacturing arrangements can be made, contraceptive supplies—orals, IUDs, condoms, and spermicides—will be a major cost, requiring foreign exchange. U.S. assistance to meet commodity needs generally involves U.S. procurement, which has constituted a large portion of U.S. assistance to Asia. Asian countries also need support for primary health infrastructures, and for technical assistance in trying new approaches to minimize per capita expenditures. In Asia, where programs are well under way, U.S. emphasis on management training and cost-effectiveness studies could be particularly useful.

In Africa, by contrast, present populations are neither as large nor as dense as those in Asia, and partly for those reasons, governments have not yet initiated extensive population/family planning programs. Assistance in health and communications infrastructure and in demographic data collection to highlight the implications of rapid population growth is the most obvious need. As with any new programs, per capita start-up costs will be high in terms of family planning users, and the socioeconomic setting will make all programs more costly, less efficient, and initially heavily reliant on external assistance. Expanded support for the work of existing private organizations is an important need.

In the Middle East and Mediterranean region, cultural constraints that affect the status of women are a greater deterrent to contraceptive use than lack of infrastructure or funds. Private agencies can play a major role in raising such issues. Where government programs exist, a major problem is reaching and counseling women on the benefits of family planning.

In Latin America, there is wide acceptance of family planning by women, but millions still lack the family planning services they desire. Greater public and private sector commitment and support are needed for family planning efforts. Despite rising demand for family planning services, some governments have been reluctant to offer family planning services and sometimes limit access to sterilization to those with large families or immediate health risks. In those countries, the most appropriate U.S. assistance is probably through the private voluntary groups and medical practitioners who have often been leaders in increasing public and official awareness of the benefits of family planning to health and development efforts.

Overall, types and levels of U.S. assistance should be in response to national efforts and needs. Where national governments are not ready to commit their own resources to population/family planning efforts, massive external assistance can become a target for political attack. Funds provided to private agencies help to encourage greater local interest and commitment, while funds channeled through professional assistance agencies and universities help to evaluate program effectiveness and to develop innovative service delivery efforts. In determining priorities for population assistance, U.S. policymakers need to weigh different regional needs and the costs of various types of assistance.

The number of couples of reproductive age in LDCs

The number of couples in LDCs who will be in their reproductive years—in which the wife's age is between 15 and 49—for the next two decades can be calculated because all but the youngest members of this group have already been born. Excluding China (its unique population status and projections are discussed in app. A), and assuming that about 70 percent of women are in some form of stable union, there are now 374 million such women living in LDCs. If these couples were to have an average total completed fertility rate of 2.2 children per couple (or replacement fertility), about 80 percent (300 million) would now need to be practicing contraception. (This 300 million allows for 10 percent who are naturally sterile and another 10 percent who are pregnant or lactating (see table 50).)

Table 50.—Basis for Estimates of Population Support Costs in 1980 and 2000

Target population	(In millions)
(1) Total LDC population (excluding China) in 1980 (medium variant)	2,310
(2) Number of LDC women 15-49	534
(3) Number of LDC women 15-49 in union (MWRA)[a]	374
(4) Number of LDC women who are fecund, ages 15-49 in union	337
(5) Number of LDC women not pregnant or breastfeeding who are fecund, ages 15-49 in union	303
(6) Number of LDC women using contraception needed to achieve replacement fertility level (80 percent of all MWRA)	300
(7) Number of MWRA needing contraception in 2000	495
Minimum per user costs[b]	**(In dollars)**
Contraceptive retail sales and community based services alone	$ 6
With clinic services and medical backup	10
With other population program components	15
With infrastructure building and training necessary for new program	50-100
Using the conservative estimate of $15 per user costs:	1980 $15 × 300 million = $4.5 billion 2000 $15 × 495 million = $7.4 billion[c]

[a] Married women of reproductive age.
[b] China expenditures are included in app. A.
[c] In 1980 constant dollars.
(3)Assumes 70 percent of women 15-49 in union.
(4)Assumes 10 percent MWRA naturally sterile.
(5)Assumes 10 percent MWRA lactating or pregnant.
(6)Replacement fertility is when crude birth rate equals crude death rate.
(7)Assumes a 65 percent increase (medium variant) in number of women needing contraception in 2000.

SOURCES: AID, "Cost Implications of Population Stabilization," March 1981; Population Reference Bureau, 1980; *U.N. Medium Variant Projections from World Population Trends and Prospects by Country, 1950-2000;* U.S. Census Bureau, *Illustrative Projections of World Population to 21st Century.*

Projected population growth in the next two decades will increase contraceptive needs by 65 percent. But with the exception of China, where contraceptive use rates are high, only about 20 percent of LDC couples are contracepting. There would thus have to be a fourfold increase in current contraceptive use for fertility to begin to fall to replacement levels. By 2000, some 495 million couples of reproductive age are likely to need contraceptive protection if population growth is to approach stabilization (see table 50). (If China's estimated reproductive-age population is added to this calculation, this number rises to 695 couples by 2000.)

Two key factors will affect the future of these LDC couples. First, a high proportion of all couples of reproductive age will be young—between 15 and 29 rather than 30 or older—because of the "baby boom" generation in LDCs that followed World War II. Their family planning needs will thus center around child-spacing.

Second, because of this high proportion of younger men and women, age at marriage may have an important effect on fertility that cannot yet be precisely assessed. If this generation defers marriage and/or childbearing for several years, say from age 17 to age 20, as is now happening in some Asian countries, fertility decline can be accelerated beyond that expected from higher rates of contraceptive use.

Estimated costs of providing family planning services and supplies

Although the number of couples of reproductive age can be estimated, the costs of providing services and supplies for these couples are more difficult to predict. Any assessment of costs will be modified by changing international and national political and economic considerations.

Although population assistance to China from UNFPA has just begun, China may request more aid in the future because of the magnitude of its population growth.

Current per-user costs in LDCs (excluding China) range from $6 to $100 annually, depending on the type and efficiency of the population program. On average, these costs are about $15 per user (see table 50). (This cost includes all program aspects, from demographic data collection and analysis to IEC, administrative support, and commodity procurements, and is thus a conservative estimate for an efficiently run program.) Using this estimate, today's cost to achieve replacement fertility, with 80 percent of couples using contraception, would be some $4.5 billion annually.

Although rates of contraceptive prevalence are unlikely to exceed 50 percent by 2000, if these rates were to rise to 80 percent, program costs could reach $7.4 billion in 1980 constant dollars. (This amount rises to $10.7 billion when China's childbearing-age population is added.) If inflation persists at about 10 percent per year, the dollar would be worth about one-eighth of its 1980 value, and the increase would be twelvefold.

Although $15 per user is a conservative estimate, if a program is efficiently run and has a good mix of methods (heavy reliance on voluntary sterilization, and sliding scales of payment by users), this figure is fairly realistic. In many regions such as Africa and the Middle East, where programs are just beginning, these costs will be much higher.

The 1982 AID budget request for U.S. population assistance was $253.4 million. Under this request, UNFPA and AID had projected shortfalls—shortages of funding for requested new projects in LDCs and for support of continuing projects—of $40 million to $100 million and about $200 million respectively. (For the UNFPA budget request this shortfall assumed that other MDCs would increase their contributions by 10 percent rather than 15 percent as in the past. See footnote ch. 1.)

Shortfalls under the actual budget of $211 million for 1982 and the projected budget of $230 million for 1983 will increase substantially as inflationary effects continue and needs for assistance rise during the 2-year period.

The countries in which population growth will be greatest in the next two decades

Priorities for assistance for the remainder of this century might center on the 13 countries that together now account for 75 percent of the LDC population and will account for the greater proportion of numbers added in the next 20 years—India, China, Indonesia, Brazil, Bangladesh, Pakistan, Nigeria, Mexico, Vietnam, Philippines, Thailand, Turkey, and Egypt (listed in order of their projected population increases).

For political and economic reasons, bilateral population assistance from the United States will not be sent to some of these countries, will be provided only minimally to others, and will focus heavily on a few. Multilateral agencies are likely to continue to address the unmet needs of certain of these countries. For example, because the Foreign Assistance Act currently prohibits assistance to Communist countries, China and Vietnam receive no direct U.S. assistance. Countries like Brazil and Mexico, which prefer not to receive direct assistance from the U.S. Government, look to UNFPA, IPPF, and other intermediaries to provide external assistance. Indonesia, Bangladesh, the Philippines, Egypt, and Thailand, on the other hand, welcome U.S. population assistance and have received substantial aid, both direct and indirect.

Growing U.S. interest in African issues and requests from African countries may also prompt increased population assistance to Nigeria, Kenya, Senegal, Burundi, Rwanda, and other nations of the region. Overall, the countries that receive the largest amounts of U.S. population assistance are not always determined on the basis of demographic priorities but rather by other interests and mutually cooperative relationships. The obvious importance of helping such nations as China, India, Brazil, and Mexico argues for a continuing multiplicity of donors and adequate funding for multilateral assistance programs of UNFPA, the World Bank, and IPPF.

Political and other considerations governing the distribution of U.S. population assistance

In the long run, levels of U.S. population assistance, like other forms of U.S. development aid, will be determined by an overall assessment of the importance of population growth to U.S. interests. The Middle East provides an important example. Because high levels of Security Supporting Assistance have been appropriated for Middle Eastern countries, population assistance to Egypt is a major effort, well-justified by Egyptian national needs but also by U.S. security interests. Population assistance for Egypt can be expected to increase in recognition of the crucial role of the "Arc of Crisis" countries of that region.

The situation in Latin America is quite different. Increasing migration to the United States from Mexico and the Caribbean is alerting U.S. citizens to the high rates of population growth of many Western Hemisphere countries. Even where the United States does not provide direct population assistance, the United States has a strong interest in encouraging multilateral or NGO assistance and expanded programs. Over the long run, lower population growth rates in Latin America and the Caribbean would be expected to reduce pressures for migration and to ease social and economic conflicts within and among countries.

The United States is likely to maintain strong political and humanitarian ties to Asian nations, three of which—China, India, and Indonesia—are projected to contribute almost 37 percent of world population growth to 2000. The government of India, which is expected to experience the world's largest population increase in the next two decades (346 million as compared to the projected U.S. increase of 38 million) has given high priority to slowing its population growth.

Africa poses a special problem with respect to levels of population assistance. While U.S. interest and concern over African development are increasing, the scope for population assistance is partly limited to demographic and census work, and informing African officials of the consequences of rapid population growth rates. There is an immediate need for increasing the number of qualified technical personnel to identify Africa's population issues and encourage consideration of these issues by policymakers.

Future funding needs for population programs will depend on both political and demographic factors. The total need is vast, but in determining which components and how much of this need should be met by the U.S. Government—either directly or indirectly—regional, programmatic, and economic considerations weigh heavily. There is a continuing role for private agencies, for U.S. government-to-government (bilateral) programs, and for multilateral agencies. This mix of different channels, which suits the mix of different national and regional needs and preferences, deserves regular review and evaluation.

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Table A-1.—Regional Distribution of All External Population Assistance

(In millions of U.S. dollars, not including regional, interregional, or global funding)

Region (country specific)	1977	Percent	1978	Percent	1979	Percent
Asia	$117.3	56%	$128.1	55%	$168.3	60%
Africa	30.6	15	32.5	14	32.2	12
Latin America	45.9	22	50.2	22	55.7	20
Middle East	14.4	7	20.8	9	23.4	8
Total	$208.2	100%	$231.6	100%	$279.6	100%

SOURCE: Office of Technology Assessment.

Table A-2.—Kinds of Population Assistance by Region, 1979

(in millions of U.S. dollars, not including regional, interregional, or global funding)

	1979	Percent
Africa		
Family planning services	$22.2	58%
Data collection	7.1	18
Information, education, and communication	2.3	6
Policy development	1.8	5
Institutions and training/ research and evaluation	4.9	13
Total	$38.3	100%
Asia		
Family planning services	$152.9	85%
Data collection	4.4	2
Information, eduction, and communication	4.2	2
Policy development	5.6	4
Institutions and training/ research and evaluation	12.3	7
Total	$179.4	100%
Latin America		
Family planning services	$55.5	81%
Data collection	2.3	3
Information, education, and communication	2.5	4
Policy development	3.2	5
Institutions and training/ research and evaluation	4.9	7
Total	$68.4	100%
Middle East		
Family planning services	$17.0	65%
Data collection	3.3	12
Information, education, and communication	1.1	4
Policy development	.3	1
Institutions and training/ research and evaluation	4.9	18
Total	$26.6	100%

SOURCE: Office of Technology Assessment.

Table A-3.—Total International Assistance Flows to 50 Most Populous LDCs, 1977-79, per Capita Dollar, 1979

	(in millions of U.S. dollars)			
	1977	1978	1979	Per capita aid/dollars
China	0	0 +	$0.4	$0.00 +
India	$19.5	$35.6	36.5	.05
Indonesia	42.4	23.8	24.2	.16
Brazil	5.0	9.0	9.7	.08
Bangladesh	18.0	20.7	43.8	.49
Pakistan	4.2	2.3	3.1	.04
Nigeria	1.4	1.4	1.9	.02
Mexico	5.3	7.6	8.3	.12
Vietnam	1.2	0.7	5.4	.10
Philippines	4.3	19.0	14.5	.28
Thailand	7.3	11.7	18.2	.38
Turkey	1.2	1.5	2.1	.05
Egypt	2.2	7.3	6.6	.16
Iran	1.1	1.9	0.1	.00 +
South Korea	5.4	3.1	8.1	.46
Burma	0.1	0.1	0.1	.00 +
Ethiopia	0.4	0.4	0.4	.01
South Africa	—	—	—	—
Zaire	0.7	0.4	1.0	.04
Colombia	7.7	7.6	11.2	.43
Argentina	0.2	0.4	0.6	.02
Afghanistan	1.2	1.6	2.5	.12
Morocco	2.5	2.4	2.4	.12
Algeria	1.6	0.5	0.3	.02
Sudan	1.3	0.6	0.3	.02
Tanzania	5.8	3.2	2.4	.14
North Korea	—	—	—	—
Peru	0.8	1.6	2.0	.12
Kenya	7.5	11.9	7.5	.47
Venezuela	0.1	0.5	0.2	.01
Sri Lanka	3.8	2.5	2.7	.18
Nepal	5.2	2.2	3.4	.24
Malaysia	1.7	2.6	2.9	.22
Uganda	0.5	0.6	0.6	.05
Iraq	0.1	0.2	0.2	.02
Ghana	2.4	1.9	2.5	.22
Chile	1.7	1.8	1.6	.15
Mozambique	0.3	—	1.1	.11
Cuba	1.3	1.0	1.1	.11
Kampuchea	—	—	—	—
Madagascar	0.2	0.4	0.5	.06
Syria	0.6	1.1	0.8	.10
Cameroon	0.1	0.3	0.4	.05
Saudi Arabia	0.0 +	—	—	—
Ecuador	0.8	0.8	1.6	.21
Ivory Coast	0.0 +	0.4	0.5	.06
Zimbabwe	—	—	0.0 +	—
Guatemala	1.2	0.8	1.0	.14
Angola	—	—	—	—
Upper Volta	0.1	0.1	0.1	.01

NOTE: Per capita dollars aid reflect 1979 U.N. medium variant population.

Table A-4.—Population Dynamics of 50 Most Populous LDCs and Selected MDCs and Regions

Country	Population, in millions		Rate of natural increase, 1981	Years to double population, 1981
	1981	2000		
China	969	1,190	0.8%	59
India	710	1,040	2.1	33
Indonesia	155	221	2.0	35
Brazil	130	212	2.4	29
Bangladesh	91	153	2.6	27
Pakistan	85	145	2.8	25
Nigeria	80	149	3.2	22
Mexico	72	132	2.5	28
Vietnam	54	79	2.8	25
Philippines	53	83	2.4	29
Thailand	49	76	2.0	35
Turkey	46	69	2.2	32
Egypt	43	65	3.0	32
Iran	39	65	3.0	23
South Korea	39	51	1.7	41
Burma	36	55	2.4	29
Ethiopia	33	55	2.5	28
S. Africa	30	48	2.4	29
Zaire	29	46	2.8	25
Colombia	28	42	2.3	33
Argentina	27	33	1.6	43
Afghanistan	23	37	2.7	26
Morocco	21	36	3.0	23
Algeria	19	36	3.2	22
Sudan	19	31	3.1	22
Tanzania	18	34	3.0	23
North Korea	18	27	2.4	28
Peru	18	29	2.7	26
Kenya	17	34	3.9	18
Venezuela	15	26	3.0	23
Sri Lanka	15	20	2.2	32
Nepal	15	22	2.4	29
Malaysia	14	20	2.3	30
Uganda	14	25	3.0	23
Iraq	13	24	3.4	20
Ghana	12	21	3.1	22
Chile	11	15	1.5	47
Mozambique	11	18	2.6	27
Cuba	10	13	0.9	77
Kampuchea	9	13	1.8	38
Madagascar	9	15	2.6	27
Syria	9	16	3.4	21
Cameroon	9	13	2.3	30
Saudi Arabia	9	16	3.0	23
Ecuador	8	15	3.1	22
Ivory Coast	8	14	3.1	22
Zimbabwe	8	14	3.4	21
Guatemala	7	13	3.1	22
Angola	7	12	2.4	28
Upper Volta	7	12	2.6	27
Sweden	8	8	0.1	1,155
United Kingdom	56	57	0.1	693
France	54	57	0.4	178
West Germany	61	59	−0.2	—
Japan	117	129	0.8	82
United States	224	260	0.7	95
Africa	483	828	2.9	24
Latin America	378	608	2.3	30
East Asia[a]	1,149	1,406	1.2	58
South Asia[b]	1,457	2,205	2.3	30
Europe	485	520	0.4	178
Oceania	23	30	1.3	54
U.S.S.R.	269	312	0.8	86
All LDCs[c]	3,357	4,926	2.1	34
All MDCs[d]	1,138	1,272	0.6	113
World	4,495	6,199	1.7%	41

[a] East Asia includes China, Japan, Hong Kong, North and South Korea, Macao, Mongolia, and Taiwan.

[b] South Asia includes the rest of Asia including Middle Eastern Arab countries.

[c] Less developed countries (LDCs) include all regions of Africa, Latin America, China, East Asia, Southern East Asia, Middle South Asia, Western South Asia, Melanesia, Micronesia, and Polynesia.

[d] More developed countries (MDCs) include Northern America, Japan, Europe, Australia, New Zealand, and U.S.S.R.

SOURCES: Population figures from, U.N., 1979—World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment. Rate of natural increase and doubling time figures from Population Reference Bureau, 1981 World Population Data Sheet.

Table A-5.—Socioeconomic and Quality of Life Indicators for Top 50 LDCs and Selected MDCs

Country	1971 GNP per capita (U.S. dollars)	1975 adult literacy rate (percent)	1981 life expectancy (years)	1981 infant mortality[a]
China	$230	NA	68	56
India	180	36	52	134
Indonesia	360	62	50	91
Brazil	1,570	76	64	84
Bangladesh	90	26	47	139
Pakistan	230	21	52	142
Nigeria	560	NA	48	157
Mexico	1,290	76	65	70
Vietnam	170	87	62	115
Philippines	510	87	61	65
Thailand	490	84	61	68
Turkey	1,210	60	61	125
Egypt	400	44	55	90
Iran	2,160[b]	50	58	112
South Korea	1,160	93	66	37
Burma	150	67	53	140
Ethiopia	120	10	39	178
S. Africa	1,480	NA	60	97
Zaire	210	15	46	171
Colombia	850	81	62	77
Argentina	1,910	94	69	41
Afghanistan	240	12	42	185
Morocco	670	28	55	133
Algeria	1,260	37	56	127
Sudan	320	20	46	141
Tanzania	230	66[b]	50	125
North Korea	730	NA	62	70
Peru	740	72	56	92
Kenya	330	40[b]	53	83
Venezuela	2,910	82[b]	66	45
Sri Lanka	190	78[b]	64	42
Nepal	120	19	43	133
Malaysia	1,090	60[b]	61	44
Uganda	280	NA	52	120
Iraq	1,860	NA	55	92
Ghana	390	30	48	115
Chile	1,410	88	67	38
Mozambique	140	NA	46	148
Cuba	810	96[b]	72	19
Kampuchea	NA	NA	45	150
Madagascar	250	50[b]	46	102
Syria	930	53	62	81
Cameroon	460	NA	44	157
Saudi Arabia	7,690	NA	48	118
Ecuador	880	74	60	70
Ivory Coast	840	20	46	138
Zimbabwe	480	NA	53	129
Guatemala	910	47	58	69
Angola	300	NA	41	192
Upper Volta	160	5	42	182
United States	9,590	99	74	13
Japan	7,280	99	76	8
United Kingdom	5,030	99	73	13
France	8,260	99	73	10

[a] Annual number of deaths to infants under 1 year of age per 1000 live births.

[b] Refers to a year other than 1975 for literacy rates.

NA - Not available

SOURCES: World Bank, World Development Report 1980, p. 110, Basic Indicators (for GNP and literacy rates), Population Reference Bureau, World Population Data Sheet, April 1981 (for "life expectancy" and "infant mortality" rates).

Table A-6.—Population Trends in Selected Countries Involving U.S. Security Interests

Country	1981 population (millions)	1981 rate of natural increase	Years to double population
Bangladesh	91.4	2.6%	27
Bolivia	5.7	2.5	28
Brazil	130.0	2.4	29
Central America	95.9	2.7	26
Egypt	43.1	3.0	23
India	709.8	2.1	33
Indonesia	155.4	2.0	35
Kenya	17.0	3.9	18
South Korea	38.6	1.7	41
Mexico	72.4	2.5	28
Morocco	21.0	3.0	23
Nigeria	79.7	3.2	22
Pakistan	85.1	2.8	24
Philippines	52.5	2.4	29
Somalia	3.8	2.8	25
Thailand	49.0	2.0	35
Turkey	46.5	2.2	32
Venezuela	15.4	3.0	23
Zimbabwe	7.7	3.4%	21

Appendixes

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Appendix A

Evolution of China's Birth Planning Policy*

Introduction

The government of the People's Republic of China (PRC) announced the adoption of birth planning as a national policy in the summer of 1956. Following its formal declaration of antinatalist policy, the government moved to train medical personnel in birth planning procedures, set up family planning clinics, initiate biomedical research on contraceptives, and implement a massive publicity campaign.

These activities were abruptly suspended in August of 1958, when the "People Commune" and "Great Leap" movements were introduced, but were resumed in the spring of 1962 in the aftermath of the Great Leap failure. Although the birth planning policy had not been under attack during the 1966-68 Cultural Revolution, the service delivery system was disrupted by administrative breakdowns. At Chairman Mao's insistence, however, a nationwide, three-tiered system of rural health care was established that laid one of the foundations for China's spectacular decline in rural fertility during the 1970's.

In 1971 the State Council, headed by the late Premier Chou En-lai, issued "Directive No. 51," which called for vigorous promotion of birth planning to reduce fertility levels as quickly as possible. The government then began to diffuse, step by step, the three reproductive norms that were to serve as guidelines for birth planning:

Late marriage.—Urban men and women were urged not to marry until age 28 or 25, respectively; for rural dweller the respective ages were 25 and 23. However, the legal age of marriage remained unchanged until September 1980, when the National People's Congress raised it from 20 to 22 for men and from 18 to 20 for women. The new marriage law became effective January 1, 1981.

Longer birth interval.—Although the first child may be planned right after marriage, a subsequent birth was expected to follow a 4-year or longer interval.

Fewer births.—Each urban couple was at that time expected to have only two children, and each rural couple three children, regardless of the children's sex. In 1977 the term "fewer births" was redefined as two children per family, whether urban or rural. In 1979 the term was further redefined to mean "one is the best; at most two; never the third."

In China, the three reproductive norms are known as wan xi shao, which means "later, longer, and fewer."

The post-Mao leadership has given top priority to the four modernizations—agriculture, industry, defense, and sciences—as the PRC attempts to raise its per capita gross national product (GNP) to $1,000 by the year 2000. In the official view, the success of this effort is contingent upon bringing about zero population growth as quickly as possible. In February of 1980, Premier Hua Guo-Feng called for reducing the country's population growth rate to 10 per 1,000 within 3 years. At about the same time, the National People's Congress approved a revised constitution, which in article 53 states that "the state advocates and encourages birth planning."

Vigorous implementation of China's birth planning policy during the 1970's produced a phenomenal decline in the country's crude birth rate, which fell from about 31 per 1,000 in 1971 to 18 per 1,000 in 1979. The official natural increase rate for 1980 was 12 per 1,000, representing a net increase during that year of 11.6 million persons.

Yet despite this unprecedented achievement, PRC policymakers remained dissatisfied with the nation's population growth rate. An internal population projection showed that if the 1978 estimated total fertility rate of 2.3 were to remain constant, the population would grow from 958 million in 1978 to 1,282 billion by 2000 and to 2,119 billion by 2080 (18). Because of high fertility rates in the 1950's and 1960's, half of the population was under age 20 in 1978; between 1980 and 1995 the number of women reaching the recommended age of marriage (23) annually will rise to between 12 million and 13.5 million, or an average increase of 18 percent over that number in 1980 (13). Even if each of these women has only one child, these births alone would exceed 10 million per year, a number equal to almost 60 percent of the total births recorded in 1978.

Faced with this awesome prospect, the post-Mao leadership in 1979 launched a two-stage campaign, which calls for the reduction of the natural increase rate to 5 per 1,000 by 1985, and achievement of zero population growth by 2,000. According to Vice Premier Chen Mu-hua, the government official in charge of China's birth planning programs, of the 17.4 million births in 1978, 30 percent, or 5.2 million, were third and higher parity births, or multiparity births. If these multiparity births were to be reduced by half, the crude birth rate could fall from the 1979 figure of 18 per 1,000 to 15 per 1,000, and the natural increase rate from 12 per 1,000 to 9 per 1,000. If multiparity births were to be entirely eliminated by 1985, there would then be 5 million fewer births, the crude birth rate would drop to about 13 per 1,000, and the natural increase to below 7 per 1,000. Because these changes would still fall short of the target for 1985 by two percentage points, the government is now promoting the one-child family. In view of the expected increase in numbers of women reaching reproductive age in the next two decades, the promotion and spread of the one-child family is considered imperative if the nation hopes to achieve zero population growth by the year 2000 (4). Since its inception 2 years ago, the one-child campaign has exceeded most expectations. By the end of 1980, 10 million couples who were parents of one child had reportedly signed the official "one-child certificate," pledging to have no more children in return for a series of benefits.

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*The People's Republic of China has established historic precedent by rapidly lowering its birth rate while still at a low level of modernization. Understanding the magnitude of China's fertility decline is essential to assessing LDC population growth prospects to the year 2000. For this reason, and because of China's significance as 29 percent of the total LDC population, a special report on events in China was prepared for this assessment by Pi-chao Chen of Wayne State University. The following summary of his report provides detailed data on China's population policies and programs and on the results of these efforts, and new information on the rapidly changing situation in the world's most populous country.

Organization and management of the birth planning programs

The agency in charge of China's overall birth planning program is the Birth Planning Leadership Group of the State Council, which was created in 1956 as the Birth Planning Guidance Committee of the State Council (9). The agency was revived and reorganized in 1963, 1973, and again in 1978, when Vice Premier Chen Mu-hua assumed its direction. Madame Chen Mu-hua has continued to head the agency since its elevation, in March 1981, to the State Birth Planning Commission. The Commission draws its members from a host of ministries, such mass organizations as the Women's Federation and the Young Communist League, and such related professional associations as the China Medical Association. Working directly under it is the Birth Planning Staff Office of the State Council, which is responsible for day-to-day coordination and supervision of the birth planning programs throughout the country. The office convenes the annual birth planning work conference, usually held in December or January, to which provincial and selected county birth planning staff offices send delegates. The work conference is one of the mechanisms used to transmit new policy directives to the lower units, receive briefings and reports from below, and cite and reward advanced units. Concrete action plans for the next year are then developed through vertical consultation.

Below the national level, each province has its own planned-birth committee (or leading group), which is presided over by a deputy party secretary of the provincial party committee or a vice chairman of the provincial government. The provincial committee draws its members from various provincial government functional departments (health, public security, commerce, education, etc.) and provincial chapters of such mass organizations as the Women's Federation, the Young Communist League, and the Trade Union Federation. Under its direction, the provincial birth planning staff office carries out the day-to-day operations of the provincial birth planning programs with a small full-time staff and a modest budget. The Guangdong Provincial Birth Planning Staff Office, for example, has a staff of 32 full-time members, who are responsible for: 1) setting annual and intermediate-term plans and targets; 2) supervising lower level units in implementing programs and realizing targets; 3) providing technical assistance to lower level units (e.g., organizing training classes in which physicians and paramedics at lower levels are trained in surgical planned birth procedures); 4) organizing information, education, and motivation activities, including the printing of posters and utilization of mass media; 5) identifying innovative, successful units within the province and diffusing their innovations by convening on-the-spot conferences to exchange experiences; 6) calling annual provincial planned birth work conferences, in which the targets for the next plan year are set (by consultations with birth planning offices at other levels), and advanced units and persons in birth planning are cited; and 7) monitoring the program's progress and collecting and tabulating its statistics.

In 1980, for example, the annual budget of Guangdong's provincial Planned Birth Staff Office was 12.5 million yuan (1 yuan is equal to 60 U.S. cents), divided as follows:

- procurement of contraceptive supplies and reimbursement for the four planned birth operations (IUD insertion and removal, tubal ligation/occlusion, vasectomy, induced abortion) (50 percent);
- information, education, and motivation (IEM) activities including subsidies to lower level birth units (30 percent); and
- manpower training and research (20 percent).

The budget covers neither the salaries of the 32 full-time staff members nor those of the planned birth workers at lower levels, whose salaries are budgeted under the overall personnel payroll of the level of the government for which they work. Part of the IEM fund has, however, been allocated to subsidize the salaries of the commune-level full-time planned birth cadres.

County birth planning offices also maintain 10 to 15 member full-time staffs. Their functions are to work out annual birth quotas; train, supervise, and supply contraceptives to the lower level units, the communes and brigades; direct IEM activities at lower levels; reimburse commune health centers for expenses generated by the four birth planning operations; and keep records and collect statistics.

Each commune has a birth planning leadership group, headed by the first Party secretary of the commune, who is its most powerful member. The group, which supervises the implementation of the local birth planning program, contains members from all relevant units within the commune: the commune Party committee, commune management committee, public security police station, commune chapter of the Women's Federation, Young Communist League, militia, local school system, commune health center, and so on.

Each brigade within the commune also has its own brigade birth planning leadership group, which supervises the local barefoot doctors, the part-time maternal and child health (MCH) workers (or trained birth attendants), and the team-level health aides who deliver contraceptives to the households and accompany the women or men to the commune health center to obtain the kind of planned birth operation they have chosen. The brigade group is also responsible for conducting local IEM activities, which are community based; community leaders (i.e., the local cadres) are deployed to educate the local people about the benefits of birth planning and persuade them of the importance of births planned in accordance with the new reproductive norms.

Urban organization of planned birth offices is similar to that of rural areas. A planned birth committee and staff office operate at the municipal level and a network of committees and offices functions at each of the various levels into which the city administrative struction is divided: the districts, neighborhoods, resident committees, and resident small groups (each of which consists of between 15 and 40 households). The organization and responsibilities of the district-level planned birth committees and staff offices are patterned after those at the municipal level, though with fewer staff and, of course, smaller areas of operation. By the early 1970's, each urban neighborhood, residents' committee, and residents' small group had reportedly set up its own planned birth committee or group (called a "group" when attached to a residents' small group). The neighborhood planned birth committee is made up of members representing the local party committee, the local administrative office (called a revolutionary committee until 1979), local chapters of the Women's Federation, Young Communist League, and Trade Union Federation, and the neighborhood hospital or clinic. Under its umbrella are several "women's work" cadres—one for each residents' committee under the jurisdiction of the neighborhood administrative office. They assist and supervise the "planned birth propagandist" at the lower levels, and supervise the paramedics (the urban counterparts of barefoot doctors) working at the neighborhood or residents' cooperative medical station who deliver planned birth services.

At the residents' small group level, a "woman representative" (who represents the women in the unit at the neighborhood chapter of the Women's Federation) is responsible for promoting planned births in her unit. Assisted and supervised by the women's work cadres at the next higher level, these women representatives carry out planned birth activities in the residents' small group—which in recent years has come to include the formulation of community birth plans, as discussed in *Community planning of births*. Women working either in the state factories or neighborhood cooperative cottage industries attend mandatory political study sessions at their place of work. These study groups, which consist of 10 to 15 workers and are headed by "women's group" leaders (the factory's equivalent of the women's representative from the residents' small group), are a variation of the government mechanism used to promulgate the official ideology. These women's groups handle the birth planning activities of the women in the group, including education, provision of contraceptive supplies, arrangement of planned birth operations, organization of the group planning of births, and record-keeping.

All large state enterprise service units and large governmental organizations such as universities and hospitals have also set up their own planned birth committees, usually headed by a deputy Party secretary or deputy director of the unit. This committee handles the planned birth program for its employees and is required to coordinate its activities with the district-level planned birth staff office, or the neighborhood-level planned birth committee. This pattern of coordination whereby the planned birth work at an individual unit must be coordinated with that of a planned birth staff office responsible for a defined geographical-administrative area is referred to in China as the "vertical and horizontal integration" pattern.

Virtually all government bodies in China operate under what is called "multiple leadership," which consists of: vertical leadership, or control by another government body with a similar function at a higher level of the administrative structure; and horizontal leadership, or control by first, the supreme local government organization at its level, and second, the local Party organization at that level. Planned birth offices are no exception. Given the enormous power of the Party organizations, what this means in practice is that only when Party members on any given level and in any given locality are active and imaginative concerning planned birth activities will these activities be well thought out and executed. This is in marked contrast to family planning programs in other LDCs, where family planning networks normally operate in isolation either as part of a ministry of health or family planning, or as a specifically created bureaucracy. Chinese sources have repeatedly admitted to "uneven progress" in birth planning work across provinces and regions, and have often attributed good performance to "strong" Party leadership and poor performance to "weak" Party leadership and involvement.

Community planning of births

The underlying philosophy of the birth planning policy is to combine state guidance (education and persuasion as opposed to administrative orders) with the "voluntarism" of the people. The government does, however, see that its wishes are carried out. The most effective tactic at its disposal is community planning of births.

Although many of its elements have changed since the promulgation of the one-child family norm, the idea behind the model is simple. Since the mid-1970's, the State Council Birth Planning Staff Office has set yearly targets for natural increase rates (births minus deaths) in the various provinces, according to such factors as socioeconomic development, previous performance, and ethnicity. Each province, upon receiving the target that the central government has established for it, sets a natural increase rate target and allocates a birth quota for each of the prefectures under its jurisdiction. This process is repeated downward until it reaches the production team (or factory, residential unit, or whatever the birth planning unit happens to be in a particular locale; for this discussion we will refer to the production team). The production team must work out its birth plan, taking into account those couples who plan to marry—for such couples must report their plans to their employing or residential units months or even a year in advance and receive permission to do so—and assigning permission to have children to those couples who have observed the three reproductive norms. Childless couples and couples intending to marry soon who have observed the late marriage norm have first priority, followed by couples who have one child aged three or older. If the eligible number of couples is larger than the quota allowed, some eligible couples must wait until the following year. Exceptions to these reproductive norms are allowed in practice wherever they are deemed justified by the local people and with the approval of the local birth planning leading group.

Each production team, having worked out its team plan, submits it to the brigade, which in turn works out a brigade plan. The brigades send their plans up to the commune, and so on. Sometimes adjustments must take place along the way; a commune committee may add quotas to one brigade and subtract them from another if it feels this is necessary.

Once a commune birth plan is approved, the members of the commune are expected to implement it. Couples who have been given permission to have a child are issued a "planned birth card" and may forego contraception; others are expected to practice contraception or to undergo abortion in the event of contraceptive failure. Because things do not always proceed as planned—eligible couples fail to conceive, an infant dies, a husband must be absent for a long time, an ineligible wife becomes pregnant accidentally—periodic adjustments must be made. If a couple who did not receive a birth quota conceives and then requests a quota, and another couple with a quota fails to conceive and agrees to give up their quota for that year, the request may be granted.

As these reproductive norms have become increasingly well understood, it is no longer necessary to call time-consuming group meetings to iron out community birth plans. Instead, eligible couples simply submit their own birth plans, and local birth planning committees work out multiyear plans in accord-

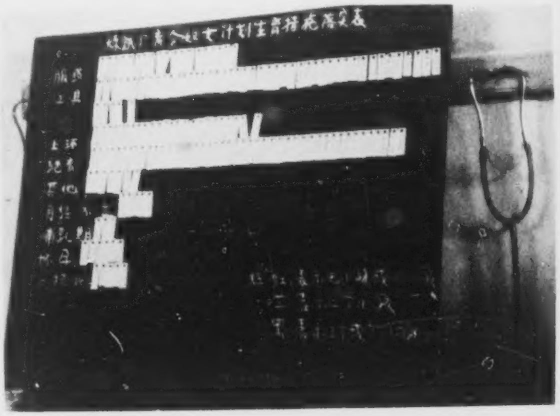


Photo credit: Leslie Corsa

The reproductive and contraceptive status of every woman in a neighborhood near Nanjing, China, is shown on the local health center's monitoring board ance with the three norms and notify the couples concerned. The latter are expected to abide by the community's decision (6,7). Because every unplanned birth in defiance of the community decision means that an eligible couple must give up a birth permission they deserve and have earned, there is a collective interest in seeing that the community plan of births is carried out. Chinese birth planning programs thus involve local communities in the planning and implementation of a policy of vital national importance. In the process, community and/or peer pressure ensures its successful implementation.

In isolated instances, local authorities, under pressure to improve program performance, have resorted to high-handed methods. These have included denying full food rations and mobilizing intense community pressure against the defiant. Couples with three or more children have also been mobilized to undergo sterilization or abortion in order to fulfill quotas. The central government has repeatedly condemned and forbidden such practices, and emphasized the importance of patient education and persuasion.

Contraceptive service delivery

PRC population programs have fared as well as they have largely because of the government's success in creating a nationwide network of primary health care systems. Each of the 2,300 counties is organized into a regionalized, integrated, three-tier health care system that provides community-based preventive, contraceptive, and primary health care to virtually every member of the rural population.

At the county level, under the overall supervision of the county health bureau, are the county hospital, anti-epidemic station, and maternal and child health hospital. These facilities supervise and provide technical support (including in-service training) to the commune health centers within the county in their respective areas of specialization.

At the commune level, a commune health center serves a population of 5,000 to 50,000 persons; it has an average of 15 to 40 beds and 25 to 50 staff members, about one-third of whom are middle-level physicians and traditional herbalists. It is responsible for preventive, curative, and surgical contraceptive services for the entire commune. The health center also supervises and provides continuous in-service training to the barefoot doctors serving the next lower level, the brigade level, who offer preventive, contraceptive, and simple curative services. Cases beyond the competence of the barefoot doctors are referred to the commune health center, which in turn refers difficult cases to the county general hospital.

At the bottom of the three-tier health service system is the cooperative medical station, manned by two to four barefoot doctors, at least one of whom is female. They supervise environmental sanitation, administer preventive health measures, treat minor ailments, and provide contraceptive services. This medical care unit is financed cooperatively, through payment of premiums by the members of the production brigade. It also receives subsidies from brigade and commune welfare funds, receipts from the growing, processing, and sale of medicinal herbs (in areas where this is done), and fees from users of the service. The state subsidizes cooperative medical services in several ways: 1) prices of some western drugs are set below cost; 2) vaccines and contraceptives are provided free; and 3) most of the initial and continuing cost of training barefoot doctors is subsidized. Once established, the cooperative medical service is expected to practice "self-reliance," raising its revenues from the abovementioned sources.

This insistence on mobilizing local resources while the state provides inputs not available locally largely accounts for the PRC's success in establishing its nationwide health care network. The three-tiered health care system, with the cooperative medical services as the base of the pyramid, provides comprehensive, community-based health and contraceptive services despite low per capita incomes and significant financial constraints.

By 1965, each of China's 2,300 counties was reported to have a well-equipped and competently staffed 100-bed general hospital; larger hospitals averaged 200-300 beds (3). By 1973, virtually all of China's 50,000 people's communes were said to have clinic/health centers, a third of them funded by the state and the remainder by the communes (8). By 1978, 80 percent of the nation's brigades, estimated to number 750,000, had their own cooperative medical service units, staffed by two to four barefoot doctors, or one barefoot doctor for every 400 rural residents (2).

Over the last few years, the number of barefoot doctors has declined, from 1.76 million in 1977 to 1.67 million in 1978 (21). Many barefoot doctors, underpaid or dissatisfied with their relatively low incomes, have abandoned paramedical practice in favor of farming. To counter this attrition, the Ministry of Health in April 1981 issued a directive, approved by the State Council, calling on rural communes and brigades to increase their subsidies to cooperative medical services and to ensure adequate compensation for barefoot doctors (11).

PRC birth planning programs have given major emphasis to providing as many contraceptive services within the community as possible. The goal of the programs is to make it possible for insertion and removal of IUDs to take place at the brigade medical station, and for the other operations (tubal ligation/occlusion, vasectomy, induced abortion) to be performed at the commune health center.

Most female barefoot doctors are trained in contraceptive counseling and some are able to perform abortions by the vacuum aspiration method. Assisted by the part-time birth attendant, MCH worker, or health aide who serves at the team level, the female barefoot doctor is responsible for providing prenatal and postpartum counseling; delivering babies; inserting IUDs and providing follow-up care; conducting contraceptive education; delivering contraceptive supplies to the homes of couples who need them; referring or accompanying to the commune health center clients who expect childbirth complications, need obstetrical or gynecological services, or wish to have one of the planned birth operations; keeping records of planned births and vital statistics for the brigade; and forwarding these statistics to the commune.

Since 1974, PRC birth planning programs have provided contraceptive services free of any charge to users. The county/municipal birth planning staff office reimburses health units that perform the four planned birth operations (i.e., tubectomy, vasectomy, insertion and removal of IUDs, and induced abortion). Women and men who undergo any of the four operations receive benefits in the form of nutritional or cash subsidies, paid leave of absence in the urban-industrial sector, and workpoints in the rural-agricultural sector.

The most popular method of contraception in China at present is the IUD (table A-1). In the estimate of the State Council Birth Planning Staff Office, IUDs account for about 50 percent of all contraceptive use in China. In Jiangsu province, which ranks as one of the country's highest-performance provinces in birth planning, IUD users account for 52 percent of all current contraceptors; in Guangdong, a poor-performance province, the figure is 55 percent.

The second most popular method is sterilization. In most provinces for which data are available, female sterilizations far outnumber vasectomies. An exception is Sichuan province, where male sterilizations reportedly outnumber female sterilizations. Oral contraceptives are apparently not well accepted in rural areas, with some notable exceptions. In Gansu province, an economically backward province in the northwest, pill users surprisingly account for 23 percent of current contraceptive users. The reason for this is not clear. In major cities, the number of pill users as a percent of total current contraceptors ranges from 17 percent in Shanghai to 26 percent in Tianjin. Two highly effective methods, the IUD and sterilization, together account for about 80 percent of all contraceptive use in China.

Induced abortion was legalized in 1956. Shortly thereafter the social indications for induced abortion were liberalized, and the procedure has since been readily available, free of charge, and granted to women on request.

Table A-2 summarizes induced abortion statistics for the whole of China. As the table shows, China's abortion rate, or number of abortions per 1,000 women aged 15 to 44, remained more or less constant in the decade of the 1970's, averaging 26 abortions per 1,000 women of reproductive age. The abortion ratio, or number of abortions per 1,000 live births, rose from 128 in 1971 to 318 in 1978. China's abortion rate and abortion ratio are very similar to those of the United States in recent years. The statistics substantiate the official Chinese position that

Table A-1.—Contraceptive Users by Method and as Percent of Total Current Users in China and Selected Provinces, 1978 and 1980

		Sterilization						
	Year	Female	Male	Both	Steroids	IUDs	Barriers	Others
China	1978	—	—	30	8	50	6	6
Jiangsu	1978	32	7	39	7	52	—	3[a]
Shanghai	1978	40	7	47	17	25	—	11[a]
Tianjin	1978	16	—	16	26	37	15	6
Guangdong	1978	20	10	30	5	60	5	—
	1980	27	11	38	4	55	1	3
Gansu	1980	26	0	26	23	37	—	15[a]

[a] Including barriers.

SOURCES: China: These are estimates by the Birth Planning Leading Group of the State Council, released to a PIACT mission in November 1979 and April 1980, PIACT, *Product News*, 1980; Tianjin: Chi'u-Lyle, 1980, p. 558; all others: Corsa and Chen, 1980.

Table A-2.—Number of Abortions, Abortions per 1,000 Women of Reproductive Age, Abortions per 1,000 Live Births, China, 1971-78

Year	Number of abortions[a]	Abortions per 1,000 women of reproductive age[b]	Abortions per 1,000 live births[c]
1971	3,910,000	21.6	128
1972	4,814,000	25.8	193
1973	5,110,000	26.6	209
1974	4,985,000	25.1	212
1975	5,084,000	24.9	242
1976	6,570,000	31.2	361
1977	5,229,000	24.2	323
1978	5,528,000	24.8	318

SOURCES: [a] Zhang, 1980, pp. 35-36.
[b] Numbers of women of reproductive age 15-44 derived from Chen's computer simulation of the population growth of China, 1953-78.
[c] Numbers of live births from Wang, 1980.

abortion is not to be used as a method of contraception, but resorted to only as a last recourse in the event of contraceptive failure.

In certain major cities for which data are available, the abortion ratio is two or three times higher than the national average. For example, in 1977 the abortion ratio was 1,231 in Xian (the capital of Shaanxi province), 818 in Changsha (the capital of Hunan province) and 1,200 in Chengtu (the capital of Sichuan province). By comparision, the abortion ratio in Guangdong province was 318 in 1977 and 439 in 1980, and in Gangsu province the figure was 303 in 1979 and 249 in 1980. The extremely high abortion ratio in some of China's major cities (which may be attributable to rural women who come to urban centers for abortion services), has led some outside observers to wrongly conclude that China has relied principally on abortion to control fertility—an assertion not supported by the available national and provincial abortion statistics.

Program performance

In the 1970's, the Chinese birth planning program evolved and diffused a system of program performance evaluation. First innovated in the major cities on the Yangtze delta, the system is designed to measure the extent to which eligible couples in a given geographic-administrative unit conform to the government-promoted reproductive norms. The system's three measures are the late marriage rate, the birth limitation rate, and the planned birth rate, which are defined as follows:

$$\text{Late marriage rate (male)} = \frac{\text{Number of men married at 25 years or age or older in one calendar year}}{\text{Total number of men married in one calendar year}} \times 100$$

$$\text{Late marriage rate (female)} = \frac{\text{Number of women married at 23 or older in one calendar year}}{\text{Total number of women married in one calendar year}} \times 100$$

$$\text{Late marriage rate (couple)} = \frac{\text{Number of men married at 25 years or older plus number of women married at 23 or older in one calendar year}}{\text{Total number of men and women married in one calendar year}} \times 100$$

$$\text{Birth limitation rate} = \frac{\text{Number of fecund married women of reproducing age practicing contraception}}{\text{Total number of married women of reproductive age}} \times 100$$

$$\text{Planned birth rate} = \frac{\text{Number of first live births to mothers conforming to the late marriage norm plus number of second live births to couples conforming to the longer-spacing norm}}{\text{Total number of births}} \times 100$$

Table A-3 summarizes the available data about the performance of birth planning programs in several provinces. Figures for the late marriage rate for the various provinces are not strictly comparable for the following reasons. First, until very recently in some provinces (e.g., Guangdong) it was possible for young couples to marry, but to wait until they reached the right ages to register the marriage, provided the team and brigade cadres cooperated (14). Second, recommended optimal ages at marriage differ not only between cities and rural counties, but also among prefectures and sometimes counties within the same province. Moreover, the demographic

Table A-3.—The Late Marriage Rate, Birth Limitation Rate, Planned Birth Rate, and Crude Birth Rate, Selected Provinces, 1977-80

Province	Year	LMR	BLR	PBR	CBR
Guangdong	1978	75	76	61	18.6
	1980	87.6	73	66.2	20.2
Jiangsu	1977	88.5	83.7	60.8	15.99
Hebei	1977	93	83	77	15
Shaanxi	1980	NA	86.1	NA	14
Gansu	1979	92	83.7	NA	16.6
	1980	83.6	83.7	NA	14.1
Shanghai:					
City proper	1978	90	85	85	7.4
Periurban counties	1978	80	80	75	15.3
Tianjin:					
City proper	1978	95.2[a]	88.8	92	15.4[a]
Periurban counties	1978		73	65	

NA = not available.
[a] Refers to the whole municipality.

SOURCES: Hebei: *FBIS*, Jan. 9, 1978, p. K4; Tianjin: Chi'u-Lyle, 1980; the rest: Chen, 1979; Corsa and Chen, 1981.

meaning of such statistics is difficult to interpret except that a relatively high late marriage rate implies a relatively high average age at marriage. However, within a province, it does measure the relative conformity to the late marriage norms among various subunits and in the same subunit over time, provided that the same definition was observed and that the degree of underregistration of marriages is of the same magnitude. To this extent, it is a useful index of program performance. Because of local variations in interpretations of planned birth norms, the figures for planned birth rates for the various provinces are not comparable. This rate is, however, a useful indicator of relative program performance.

The birth limitation rate used in Chinese programs differs from the contraceptive prevalence rate commonly used in international comparisons. The principal difference is that the denominator excludes naturally sterile women, who become a large proportion in the older age groups. Another difference is that the numerator is derived from program statistics that usually credit partial use of contraception during the year with full use. Thus, a Chinese birth limitation rate of 70 is comparable to a contraceptive prevalence rate of 60, as commonly used internationally.

There is little doubt that China's programs have succeeded in raising average age at first marriage substantially. In Shanghai county, a periurban county under the jurisdiction of Shanghai, the average female age at first marriage rose from 20.9 in 1955-59 to 24.96 in 1975-79 (26). These figures may be compared with an average age at first marriage for females of 17.7 in north China in 1929-31 as obtained from John Buck's land utilization survey (2). There is also little doubt that the Chinese programs have succeeded in persuading an overwhelming majority of women of reproductive age to regularly practice contraception. A birth limitation rate of 70 percent and above is very different from the situation in the 1930's, when it may reasonably be assumed that the deliberate practice of contraception was virtually nonexistent in China.

A rapid, substantial increase in women's age at first marriage has an immediate, substantial depressant effect on the crude birth rate, provided there are no or few premarital births. By vigorously promoting late marriage, rapidly increasing the use of effective contraception, and terminating about one-fourth of pregnancies, the Chinese programs were able to sharply reduce China's crude birth rate from 31 per 1,000 in 1971 to 18 per 1,000 in 1979. However, the benefit derived from the rapid substantial rise in age at marriage is by its nature a one-time occurrence. Although the majority of young women have been restrained by the programs from marrying before reaching the required age and thus delayed their first birth, once they reach that age they can marry and are then entitled to receive permission to have their first child. This, together with the much larger cohorts of young women who were born in the high-fertility period of the 1960's and are now nearing marriage age, will result in a vast increase in the number of women entering the approved childbearing ages, beginning in 1983. The process has already begun in a number of cities and provinces. This dramatic surge in numbers of women eligible to bear children is a major reason for the initiation of the one-child campaign. The campaign's success would prevent a new surge in the crude birth rate during the 1980's and enhance China's likelihood of achieving population stabilization by the end of the century.

The historic one-child campaign

In the August 1979 article in which she made public the government's intention to encourage one child per family, Vice Premier Chen Mu-hua indicated that a "planned birth law" designed to encourage the spread of the one-child family would soon be promulgated. Several drafts of the proposed planned birth law have been circulated at the grassroots level for comments and feedback. By August 1980, the eighth draft of the law was in circulation. However, the only legislation that has so far been enacted is the upward revision of the minimum legal age at marriage, passed by the National People's Congress in September 1980. Three reasons are believed to account for this lack of formal legislation on the one-child family. First, PRC policymakers have apparently not been able to reach a consensus on an experiment of this nature. Second, the law involves both monetary and nonmonetary rewards for couples who pledge to have only one child, raising the ques-

Photo credit: J. Chao and Population Information Program, Johns Hopkins University

One child family in Shanghai, shown with grandmother

tion of financing such rewards. Third, there are questions about the enforceability of the law in cases where couples defy the government admonition not to have a second birth, and of how the law would apply to national minorities, who so far have been affected by the birth planning policy selectively and less profoundly than the Han Chinese.

What has happened instead is that in September 1980 the Chinese Communist Party issued an open letter to all members of the Party and of the Young Communist League, which numbers 86 million, to take the lead by practicing the one-child-per-family norm (16). Using the draft planned birth law as a model, most provinces took the initiative in drawing up and promulgating their own provincial planned birth regulations on a trial basis.

The specific incentives offered by these provincial trial measures vary among provinces. All, however, contain generous economic and noneconomic incentives to one-child couples who pledge to maintain this status. Upon obtaining a one-child certificate, couples in urban areas are entitled to such benefits as: a monthly stipend ranging from 5 to 8 percent of the mean monthly wage for workers in urban-industrialized sectors, to continue until the child reaches 14 years of age; living space equal to that of two-child families, and preferential treatment when applying for housing; supplementary retirement pensions over and above those provided for under the current labor protection law; and priority consideration in job assignment and in admission to desired schools for the only child. Couples who have no children, but intend to stop at one child, are not eligible to apply for the certificate until their first child has been born.

In rural villages, couples who sign the one-child pledge are to be rewarded with as much as an extra month's work points for each of the child's first 14 years. The child can receive an adult's grain ration and count as 1.5 persons in the allocation of private farming plots. When the couple is unable to work because of old age, the official goal is to provide a standard of living equal to or higher than the local average.

In both cities and villages, should the only child of a one-child couple die, the parents may have another child and continue to enjoy the same benefits. If, however, they break their pledge by having a second child, they would have to return all stipends or workpoints received and would be fined.

Virtually all Chinese provinces are now believed to have promulgated their own trial regulations. In August 1981, Shanghai, the pace setter in birth planning in urban areas, promulgated a set of revised planned birth regulations. The new regulations retain previous measures aimed at spreading the one-child norm, and add new provisions designed to encourage late marriage, late births, and to "strictly control the second birth." Young men and women who marry after they reach 27 and 25 years of age are entitled to one extra week of wedding leave. Women who give birth to their first child after they reach 25 years of age (23 in periurban counties) are entitled to 15 extra days of maternity leave. Second parity births are to be strictly controlled by denying birth permissions to current one-child couples except for special circumstances (e.g., the one child has congenital, nonhereditary disease and will not grow to become a regular laborer; remarried couples who have only one child; couples certified by hospitals to be sterile who consequently adopted a child only to have their own child later) (23).

These provincial trial measures in effect reverse former welfare policy. Prior to 1977, official rules and regulations used in allocating housing, living space, welfare subsidies in urban areas, and in allocating basic grain and private farming plots in rural areas favored large families, and therefore had a pronatalist effect.

In the 2 years since the government's formal announcement of its one-child campaign, Chinese birth planning programs have placed major emphasis on raising the one-child certificate rate and the ratio of first births per 100 total births. Table A-4 summarizes data on the first-birth ratio for several provinces. Sichuan, the pace setter in birth planning for rural China, appears to have set the pace once again. In 1979, first births accounted for 72 percent of total births among this province's 100 million population.

Table A-4.—First Parity Births as Percent of Total Births, 1979-80

Area	First parity births as percent of Total Births 1979	1980
China	—	51
Beijing:		
Western District	77.7	86.1[a]
Shanghai	52	—
Shanghai county	74	80
City proper	—	95[b]
Periurban counties	—	75[b]
Gansu	NA	57[c]
Shaanxi	NA	53
Guangdong	NA	43
Sichuan	72	—

NA - Not available.

[a] As of the first half of 1980.
[b] As of the first quarter of 1980.
[c] As of June 1981.

SOURCES: China: *JKB*, June 7, 1981; Shanghai and Sichuan: Li, 1980; all others: Corsa and Chen, 1981.

Table A-5.—Number of One-Child Certificate Holders, and the One-Child Certificate Rate, 1979-80

Area	Date	Number of one-child certificate holders	One-child certificate rate[a]
China	December 1979	5,000,000	29
	December 1980	10,000,000	—
	June 1981	11,000,000	57
Beijing	June 1980	220,000	78.6
Jiangsu	February 1980	930,000	68
Zhejiang	December 1979	120,000	NA
Shandong	March 1980	1,170,000	77
Gansu	December 1980	—	25.6
Shaanxi	December 1980	—	79.6
Guangdong	December 1980	—	21.9
Liaoning	December 1979	NA	68
Sichuan	December 1979	400,000	—
	December 1980	1,700,000	NA

NA - Not available.

[a] Defined as number of one-child certificate holders as percent of total one-child couples.

SOURCES: China, 1979; Li, 1980b: *RMRB*, Feb. 11, 1980; 1980: *RMRB*, Jan. 27, 1981; 1981: *JKB*, "Continue to Promote One Child per Couple," June 7, 1981; Beijing: *Survey of World Broadcast*, FE/6645/B11/17, Feb. 10, 1981; Shanghai: *RMRB*, July 3, 1980; Jiangsu: *RMRB*, Feb. 11, 1980; Zhejiang: *RMRB*, Feb. 11, 1980; Shandong: *Survey of World Broadcast*, FE/6431/B11/12, May 29, 1980; Liaoning: *RMRB*, Feb. 11, 1980; Sichuan: Xinhua, Mar. 13, 1981; all others: Corsa and Chen, 1981.

The record in Shanghai, urban China's pace setter in birth planning, is no less impressive: the first-birth ratio was 95 percent in the city proper and 75 percent in periurban counties in the first half of 1980. In Gansu and Shaanxi, two economically backward provinces to the northwest, first birth ratios were 57 and 53 percent, respectively, in 1980. Even in Guangdong province, where the birth rate in 1980 was the highest of all provinces (excluding the autonomous regions), the first-birth ratio was 43 percent. According to Madame Li Xiu-zheng, deputy chairman of the State Planning Commission and director of the State Council of Birth Planning Staff Offices, first births accounted for 51 percent of all births in China in 1980 (11).

To measure the one-child campaign's relative progress, the Chinese programs have coined a "one-child certificate rate," defined as the percent of one-child couples who have obtained one-child certificates (thereby pledging not to have a second child). Table A-5 summarizes available statistics about the progress of the one-child campaign in several provinces. By the end of 1979, 29 percent of one-child couples had signed one-child certificates. By the end of 1980, more than 10 million one-child couples had signed up. By June 1981, according to Madame Li, 11 million one-child couples had signed up for the certificates, accounting for 57 percent of the nation's estimated total of 20 million one-child couples (about 10 percent of married women of reproductive age) (13). The one-child campaign has fared still better in several provinces. In Sichuan province, one-child certificate holders rose from 400,000 in 1979 to 1,700,000 in 1980. By the end of 1980, Shangdong and Shaanxi had achieved one-child certificate rates of 77 and 80 percent, respectively. Even in "backward" Guangdong, 22 percent of one-child couples had signed one-child certificates by the end of 1980.

Because of the way in which the one-child rate is defined, it will fluctuate substantially from year to year, since both the numerator and the denominator will change drastically from one year to another. Moreover, with numbers of women reaching the age of reproduction expected to average more than 10 million each year, the one-child campaign will do well to raise the one-child rate to 50 percent and maintain it at that level for any extended period.

The son-preference found among the overwhelming majority of rural peasants is a product of Confucian heritage reinforced by a rational calculation of old-age security needs. Although there is an adequate old-age pension system for a large proportion of those employed in the state-owned, urban-industrial sector, these employees number no more than 10 percent of the total population. In rural areas, agricultural collectives provide some security assistance, and are setting up the "five-guarantee household" system (whereby childless old people are guaranteed food, shelter, medical care, clothing, and burial by the collective), and institutionalized old-age care. But because it will be decades before the agricultural collective units can afford these expenses, in today's China, as in the past, the average person must look to his or her son(s) for support in the declining years. And time-honored tradition calls for the son(s) and not the daughter(s) to support aged parents. Under such circumstances, the average peasant couple may not be ready for the one-child family if their first child is a female. The Chinese programs have promoted and arranged matrilocal marriage in recent years in cases where the bride's parents have no male child. This helps reduce multiparity births, but is likely to have little impact on the one-child campaign. If two families each have one child—one male and the other female—the questions of whose home they will live in upon marriage and whose parents they will support in old age become crucial. If they try to support both, the strain on their resources would be twice that of couples who support one set of parents. From the parents' point of view, two children, whatever their sex, are clearly better old-age insurance than one. Given the sex ratio at birth, believed to be 106 males to 100 females for the Chinese population, a 50-percent one-child certificate rate is probably the maximum feasible rate the one-child campaign can hope to sustain over a long period of time.

Population growth prospects to 2000 and beyond

The Chinese Birth Planning Commission appears to be in agreement with the assessment that the maximum feasible one-child certificate rate is 50 percent. Wang Shou-dao, a member of the Commission and the President of the China Birth Planning Association, reportedly told a visiting Japanese delegation that "our current program is aimed at reducing the average number of children per married couple to 1.5 on a step-by-step basis" (10). A total fertility rate of 1.5 implies, among other things, total elimination of third and higher parity births and a 50 percent one-child rate.

When she formally announced the launching of the one-child campaign in 1979, Vice Premier Chen Mu-hua indicated the campaign's target was the realization of zero population growth by the year 2000.

What will China's population size be in 2000 if the one-child rate can indeed be sustained at 50 percent over the next few years? And when will China achieve the coveted goal of zero population growth? According to Chen's computer simulation of the future growth of China's population (using the scattered demographic data available to the outside world), if China can raise its one-child rate to 50 percent by 1983 and maintain it at that level thereafter, China's population would reach 1.189 billion in 2000, an increase of only 18 percent over the 1978 total. Thereafter, the momentum of population growth would so weaken that the annual net increase would amount to about 2 million. By the end of the first decade of the 21st century, China would achieve zero population growth.

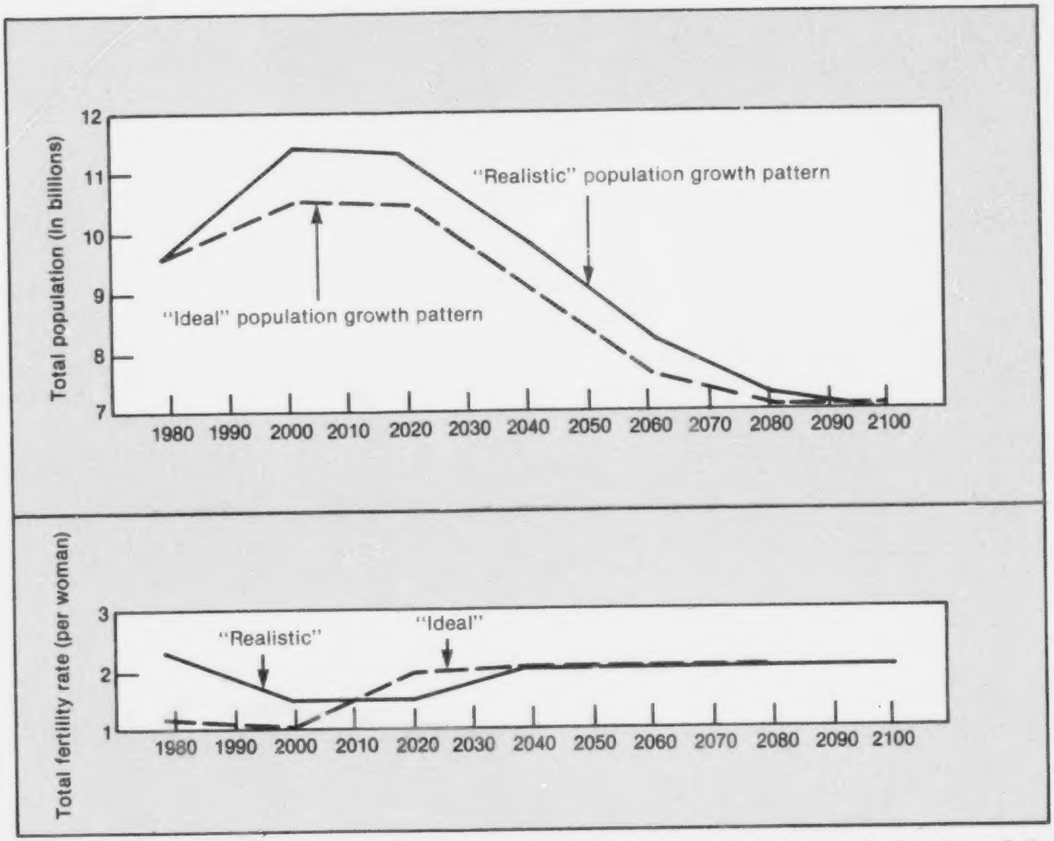
A computer simulation undertaken by a group of Chinese population scientists in 1981 arrived at a figure more or less similar to Chen's: 1.14 billion in 2000 if the total fertility rate were to be brought down to 1.5 in the next two decades.

If the Chinese government should decide to continue its one-child campaign after its population reaches zero population growth, China's population would decrease in absolute size, and the proportion of population aged 65 and above would steadily increase. If this policy were to continue in force, it would pose formidable social problems in the third and fourth decades of the 21st century. Obviously, Chinese policymakers have by now been informed by China's population scientists of the long-term consequences of indefinite pursuit of the one-child campaign.

In implementing the one-child campaign, the Chinese government hopes to persuade 50 percent of couples born in the 1960's and 1970's to forego the privilege of having two children, thereby avoiding otherwise inevitably high population growth rates in the next two decades, and bringing China's population to zero growth in 20 to 30 years. After realizing zero population growth, the government would presumably allow the fertility rate to rise to replacement level, or 2.16, but no higher, and stabilize it at this level for several decades.

In view of the lack of necessary information and the magnitude of a decision of this nature, it is difficult to imagine that the Chinese government has formulated its long-term population policy beyond the next three decades. A group of Chinese population scientists, however, recently advocated two scenarios (fig. A-1). The first scenario calls for reducing total fertility to 1 by 1985, and allowing it to rise to 2.16 after 2000, which would stabilize China's population at 700 million in 2070. The second scenario calls for reducing the total fertility rate to 1.5 by 1990, and allowing it to rise to 2.14 after 2025. If this scenario were to be followed, China's population would stabilize at 700 million by the end of the 21st century. Although the scientists suggested that the government strive to realize the first scenario, they conceded that it was not feasible. They did, however, strongly advocate striving to realize the second scenario, maintaining the total fertility rate at 1.5 in the next several

Figure A-1.—The "Ideal" and "Realistic" Population Growth Pattern, China, 1978-2100



SOURCES: Gong Xi-fang, "An Optimal Analysis of Population Planning," presented at the Third National Symposium on Population Science, Beijing, Feb. 19, 1981; and Song Jian, et al., "Report on An Investigation into the Most Optimal Population Size for Our Country," paper presented at the Third National Symposium on Population Science, Beijing, Feb. 1981.

decades so that China's population would not exceed 1.2 billion when it reaches its peak size (19).

The greatest problem of the one-child campaign to date appears to be the financing of its economic rewards. Thus far, the government has taken the easy step of mandating all employing units in urban areas and collective units (i.e., the commune, the production brigade, or the production team) in rural areas to pay for both cash and noncash benefits. In the urban industrial sector, all workers or government officials work for employing units "owned" either by the collective or by the state, which ultimately shoulders the burden of financing benefits to one-child families. In rural areas, mandating the collective unit to pay for such benefits in effect means that those couples who pledge to have only one child benefit at the expense of those families who are either ineligible or unwilling to make such a commitment. Since the income and living standard of the urban industrial population is already much higher and less subject to cyclical fluctuation, it is difficult to justify a policy that calls upon rural collective units to bear this burden without subsidy.

The provincial trial measures call for payment of 48 to 60 yuan (about 29 to 36 U.S. dollars) or more per year to the one-child family for 14 years. In 1980, this amounted to about $0.34 (U.S.) per capita. In addition, commune and brigade costs for planned birth staff salaries rose to about $0.25 (U.S.) per capita, and subsidies to couples having a planned birth operation were about $0.15 (U.S.) per capita. A slight increase in the state contribution for county and higher level staff salaries, contraceptives, planned birth operations, training, and publicity, to about $0.24 (U.S.) per capita, raised the overall 1980 governmental costs for China's planned birth program to a world high of about $0.98 (U.S.) per capita, or a total approaching $1 billion in U.S. dollars. As the number of one-child certificate holders increases, this will become a sizable financial burden for an economy

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whose per capita GNP is only 256 U.S. dollars. Whether the government is prepared to take on this financial burden by centralizing the financing of the one-child payment remains to be seen.

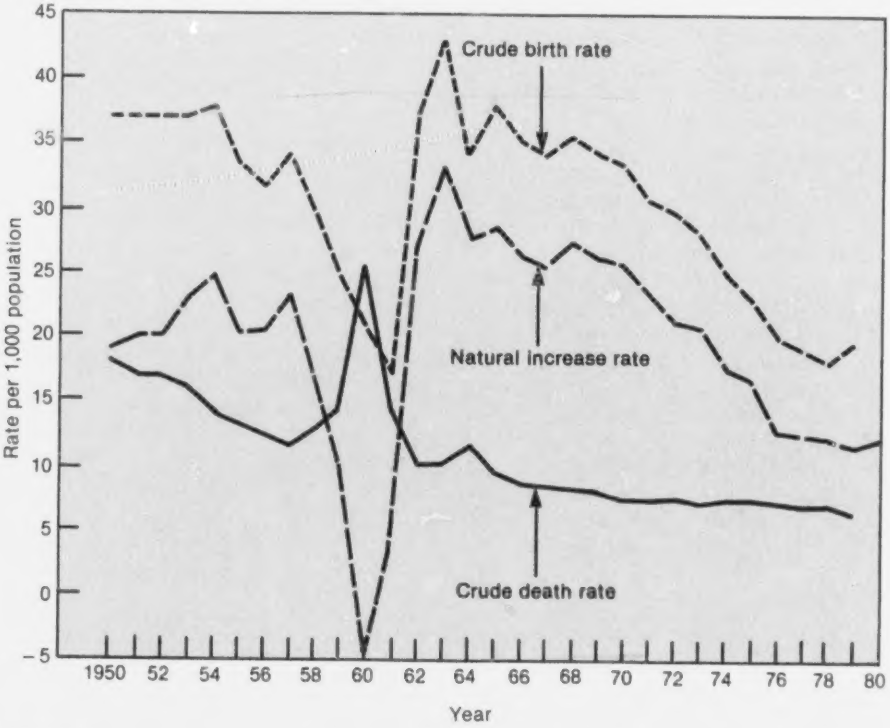
Conclusion

The PRC accomplishment in birth planning in the last decade is unprecedented in the annals of organized fertility reduction. Despite its youthful age structure, China's crude birth rate declined from 34 per 1,000 in 1970 to 18 in 1979 (fig. A-2). This is a remarkable feat for a country where most of the population lives in rural areas, the labor force is largely agricultural, and the per capita income is very low.

However, the PRC government has made tremendous strides in education, the emancipation of women, and health. By 1978 China had achieved virtual universal education for its vast numbers of young people; more than 96 percent of elementary school-age children were attending school. Although the lives of contemporary Chinese women remain very different from those of their sisters in western Europe and North America, their legal and social status has improved tremendously since 1949. This improvement is particularly marked when the status of Chinese women is compared with that of women in nearly all other LDCs. China's accomplishments in public health and medical care are best measured by the life expectancy of its population: a recent estimate by western demographers yields a life expectancy at birth of 63 to 64 years for 1975 (1).

PRC government efforts to provide minimum but equitable living standards, universal primary education, equality for women, and basic health care for its vast population have greatly strengthened the

Figure A-2.—The Vital Trends of China, 1950-80



SOURCES: Tian, Zue-yuan, "China's Population Development in the Last 30 Years," *Chinese Science and Technology Historical Source Materials*, no. 3, Sept. 1981, pp. 18-27; Li, Chenrui (Deputy Director of State Statistical Bureau), "General Trend of Change Concerning Birth and Death Rates in China," paper presented at the Asian Conference of Parliamentarians on Population and Development, Oct. 1981, Beijing, October 1981; Sun Yefang, "Consolidate Statistics Work, Reform the Statistics System," Jungji Guanli (Economic Management), no. 2, Feb. 13, 1981, translated into Foreign Broadcast Information Service, Mar. 26, 1981; State Statistical Bureau, "Principal Statistical Figures of the National Economy," May 1980; and State Statistical Bureau, "Communique of the State Statistical Bureau," Xinhua News Agency Apr. 29, 1981, translated into *Survey of World Broadcasting* FE/6711/C/1-9, Apr. 30, 1981.

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government's appeal to the populace to accept the new reproductive norms. But the central factors in the PRC's success in birth planning have been the government's commitment of enormous resources, its capability to organize and implement a vigorous, highly organized birth planning program, and the apparently widespread grassroots support for these efforts. No government has ever committed greater human and financial resources to limiting its population growth, nor has any other government been able to rally the degree of community-level commitment and support seen in the PRC.

The task the PRC government has set for itself for the next two to three decades is even more prodigious. Enormous resources have been committed to its accomplishment. PRC leaders have repeatedly indicated that the success of China's four modernization programs is contingent upon realizing the demographic target they have set for the country in the next 20 to 30 years. China's experience in socioeconomic development has borne them out on this point. The population increases of the last three decades have offset their efforts to improve living standards in many areas. Although the total grain output has almost doubled in the last 30 years, there has been virtually no improvement in per capita grain output, which increased from 234 kilograms in 1952 to 260 kilograms in 1980. Population growth combined with the conversion of cropland to industrial and residential use has reduced cropland over the last three decades to the point that in 1979 arable land per farmer in China was a mere 0.12 hectares—lower than the amounts of land per farmer in Bangladesh—0.15 hectares—and South Korea—0.14 hectares. Even densely populated India has an amount of arable land per farmer of 0.45 hectare. Over the long run, the ability of the PRC government to improve the nutrition, living standards, health, and education of its population will depend on its success in limiting population growth. Its ability to create jobs for its burgeoning labor force and to bring about acceptable rates of economic growth are all contingent on successful population limitation efforts.

PRC population programs have succeeded virtually without external assistance. The PRC government did not become the recipient of external assistance in population activities until June 1980, when the United Nations Fund for Population Activities approved a 4-year, $50 million population assistance program for China. Most of these funds will go toward the import of hardware such as computers and materials for contraceptive manufacturing plants, leaving little for technical assistance and personnel training. The World Health Organization and the Rockefeller Foundation have also provided small grants to China to support small-scale biomedical and contraceptive research.

To successfully implement its ambitious population programs, China needs more information and scientific knowledge than it now possesses. In the near future China will require extensive scientific expertise to allow policymakers to plan and implement population programs, to continuously monitor and evaluate their progress, to anticipate their consequences, and to develop appropriate policy options.

Because China constitutes one-fifth of the world's total population, its population programs are a matter of worldwide concern. China's success in achieving population stabilization in the next 20 to 30 years will have global significance, as the Chinese population accounts for almost 30 percent of the LDC population total.

Neighboring Japan, which has become a major donor of international population assistance, will shortly initiate a program of population assistance to China at the request of the PRC government. Political stability and economic prosperity in China, which will depend to a great degree on its success in planning its population growth, will also be of strategic importance to the United States.

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Appendix B

Indonesia Looks Toward Continued Fertility Decline*

Rapid population growth on the island of Java was recognized as a problem as early as 1800 by Indonesia's Dutch colonial rulers. Pressures were particularly acute in the crowded city of Jakarta. Java's carrying capacity had become seriously threatened by 1900, when a policy of redistribution or "transmigration" was begun, in which individuals and families were moved from this densely populated region to the sparsely inhabited outer islands of the archipelago nation.

Yet official recognition of Indonesia's high growth and birth rates as constraints to national well-being was slow in coming. In 1964, measures to reduce birth rates were not considered to be in keeping with Muslim customs and morals, and the administration of then-President Soekarno felt that the nation's population pressures could be adequately eased by transmigration, which could also provide the means to develop an economic and agricultural base on the outer islands.

The first advocates of family planning in Indonesia were private groups that provided services and information in the early 1950's to an educated and highly motivated urban middle class. These small groups later merged to form the voluntary Indonesian Planned Parenthood Association, which set the stage for eventual governmental initiatives. The first official government action took place in 1968 when Soeharto assumed the presidency and was one of 20 heads of state to sign a U.N. declaration on population which stated that "the number and spacing of children is a basic human right." An ad hoc advisory committee then recommended the establishment of a national family planning program for Java and Bali, which was initiated in 1969. REPELITA I (1969-73) was the first National Development Plan to include a family planning component and set a target (3 million) for new contraceptive users. In 1969-70 the National Family Planning Board was established, and the groundwork laid for what was to become one of the world's most successful family planning programs.

Photo credit: Agency for International Development

Indonesian mother and baby participating in Indonesian maternal and child health care program

REPELITA II (1974-78) cited rapid population growth as the country's most important problem and family planning as the major focus of its population policy. This plan called for 8 million to 12 million new users in Java and Bali and 1 million new users in the outer islands within the 5-year period. These goals were supported by strong statements urging the adoption of a small family norm through intensive information, education, communication/motivation activities, and innovative approaches toward the delivery of family planning services.

The current population policy of REPELITA III calls for further expansion of family planning efforts to all regions of the country, stresses the need for developing the outer regions through planned and voluntary transmigration, and recommends a national demographic policy aimed at slowed population growth, reduced infant mortality, and more even distribution of the population.

International population assistance to Indonesia began in 1968, when the government initiated official support of family planning. At that time the country provided a very small amount (4 percent—see table B-1) of the total dollars spent on its population activities. AID was the major foreign donor and has continued to be a major source of assistance over the 12-year period. During the period 1968-78 AID contributed $43.2 million in grants and $14.3 million in loans. Total funds provided to the Indonesia family planning program through 1978 totaled $208 million; of this amount, 50 percent was provided by the Indonesian government, 28 percent by AID (which includes AID intermediaries as well as donations to multilaterals), and 22 percent by other foreign donors. The trends outlined in table B-1 reveal the government's growing willingness to provide support for its own program (61 percent in 1978). At the same time the kinds of assistance provided by major donors have shifted. AID, for example, had historically delivered its assistance in the form of contraceptive commodities and funds for developing and supporting family planning service activities. In keeping with an overall government policy shift to promote self-sufficiency, AID is now—along with UNFPA—providing raw materials for the local production of contraceptives. The government's goal is self-reliance in the production of oral contraceptives by the years 1985-90. The main focus of assistance for AID and most international donors, however, continues to be the provision of commodities to and support for Indonesia's village family planning program.

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*Family planning program efforts have had a remarkable impact on the island nation of Indonesia, where fertility rates have fallen significantly in recent years. In Kenya, by contrast, high birth rates persist despite substantial population assistance efforts. The following brief overviews by David Cantor of activities in these two countries indicate the wide range of sociocultural influences to be considered in the development of family planning programs in LDCs and the importance of country-specific approaches to the provision of fertility planning services.

The National Family Planning Coordinating Board, the semiautonomous government agency responsible for family planning, began a clinic-based operation in 1969. This became a broad-based community distribution system known as the Village Family Planning Program in 1974 and has within the last 2 years begun to reach beyond the Java-Bali region to the outer islands.

The initial clinic approach to family planning was well received because government leaders viewed the issue as primarily one of health care. Numbers of new contraceptive users grew through this approach by some 50,000 each year. Their numbers were increasing by more than 1.6 million per year by 1974; condoms and pills were the main methods of choice. The government felt that although the clinic program was successful, achieving the kind of fertility decline outlined in REPELITA II—a 50 percent drop in fertility by the year 2000—called for an intensive outreach effort to bring family planning services to the people.

An important aspect of the present Village Family Planning Program is the way in which the distribution network is organized. Like the Indonesian political structure, the services delivery network has a hierarchically organized, top-to-bottom organizational approach (see table B-2). The Ministry of Health clinics provide basic services and supplies to subdistricts and to village outpost points or contraceptive supply depots. These depots in turn service several village user or family planning groups which are the basic units of the distribution system. The contraceptive supply depots are staffed by volunteer village leaders who are responsible for registering eligible couples and maintaining contraceptive records.

These influential village leaders include such figures as chiefs, religious leaders, and school teachers, who are recruited and trained to both establish and monitor the contraceptive supply depots at the village level. They in turn form village subgroups that consist of current contraceptive users among whom individuals are chosen to recruit new contraceptive users. These village subgroups also serve as forums for promoting such other activities as nutrition education and overall family welfare.

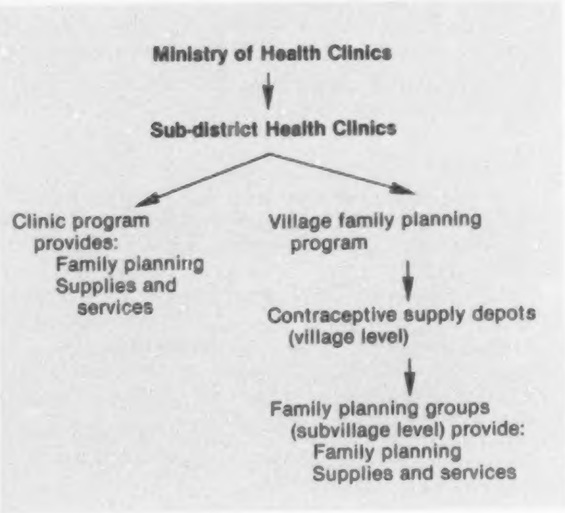
Table B-1.—Indonesian Population and Family Planning Program Financial Resources, Government of Indonesia (GOI), and Foreign Donor, 1968-78

	1968	1969	1970	1971	1972	1973	1974	1975	1976[a]	1977[a]	1978[a]	1980[a]
GOI family planning:												
In thousands	$75	$300	$1,323	$2,300	$5,134	$5,885	$8,400	$12,500	$15,600	$20,700	$33,100	$49,700
Percent	4	19	29	44	53	41	40	49	48	54	61	65
Foreign donor inputs:												
In thousands	$2,051	$1,288	$3,319	$2,913	$4,600	$8,552	$12,636	$13,000	$16,600	$17,700	$20,800	$26,914
Percent	96	81	71	56	47	59	60	51	52	46	37	35
Total GOI and foreign donor inputs:												
In thousands	$2,126	$1,588	$4,642	$5,213	$9,735	$14,437	$21,036	$25,500	$32,200	$38,400	$53,900	$76,614
Total per capita	$0.028	$0.021	$0.060	$0.076	$0.120	$0.177	$0.263	$0.297	$0.272	$0.324	$0.395	—
Total per acceptor	$80.90	$29.90	$25.61	$10.04	$9.02	$11.02	$14.26	$15.40	$14.55	$16.64	$21.22	—

[a] Includes Java and Bali plus 10 Outer Island Provinces. Prior year figures for Java and Bali only.

SOURCE: AID estimates from various sources.

Table B-2.—Flow of Contraceptive Services and Supplies


Ministry of Health Clinics
Sub-district Health Clinics
Clinic program provides: Family planning Supplies and services
Village family planning program
Contraceptive supply depots (village level)
Family planning groups (subvillage level) provide: Family planning Supplies and services

The Village Family Planning Program has been operating in Java-Bali since 1975, and in parts of the outer islands since 1977.

In 10 years (1968-78) the programs of the National Family Planning Board have recruited 13 million new contraceptive users. In March of 1979 current contraceptive users totaled 5.5 million (see table B-3). In Java and Bali this represents 30 percent of all married (or cohabiting) fecund couples.

A different perspective of this program success is provided by a summary of the impacts of these interventions since their inceptions. In 1970 the rate of population growth in Indonesia was about 2.5; today it is estimated to be between 1.9 and 2.0. In Java and Bali, where the impact can best be measured, a 15 percent drop in fertility occurred during the 10-year period from 1969 to 1979. The crude birth rate during this period fell from 45 per 1,000 to 33 per 1,000—a drop of more than 25 percent.

Effects of family planning program

How much has Indonesia's comprehensive program contributed to reducing the country's fertility rate? How much population growth would have occurred had there been no family planning program? How much and to what extent have such natural phenomena as later age at marriage or economic growth contributed to this reduction?

A demographic analysis designed to quantify the change in fertility rates in Java and Bali due to family planning interventions was carried out by the Community and Family Study Center, University of Chicago, using 1971-76 data (see table B-4). The first column measures the fertility rate changes that would have occurred naturally due to various social and economic phenomena. The second column is based on very optimistic assumptions of contraceptive use; the third column uses a more conservative projection. Actual rates are reliably considered to fall between the second and third columns.

Substantial fertility declines due to family planning program efforts are particularly noticeable on East Java and Bali. By lowering crude birth rates to more closely correspond to previous reductions in death rates, Java and Bali are undergoing their own demographic transition as growth rates, based on either high or low program estimates, fall substantially. According to these figures, family planning measures are largely responsible for slowing the population growth rate between 1971 and 1976.

Influence of political, cultural, religious factors

What has brought about the apparently overwhelming success of family planning interventions in Indonesia (particularly Java and Bali) in lowering birth rates? The general consensus points to a fortuitous combination of circumstances, events, timing, and dedicated people. The replication of these conditions in other LDC cultures is considered highly unlikely.

Table B-3.—Contraceptive Use Rates by Method, 1978

	IUD	Percent	Pill	Percent	Other	Percent	Total
Java-Bali	1,413	28	3,197	64	392	8	5,002
Outer Islands	81	15	373	69	85	16	540
Indonesia total	1,494	27	3,569	64	478	9	5,542

NOTE: Figures may not add due to rounding

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Table B-4.—Annual Growth Rates Under Various Assumptions for Java-Bali

	Annual growth rate				Annual growth rate		
Province	No family planning	High program	Low program	Province	No family planning	High program	Low program
Jakarta:				Yogyakarta:			
1971	2.9	2.9	2.9	1971	1.5	1.5	1.5
1972	2.9	2.8	2.8	1972	1.5	1.4	1.5
1973	2.9	2.7	2.7	1973	1.5	1.3	1.3
1974	2.9	2.6	2.7	1974	1.5	1.1	1.1
1975	3.0	2.5	2.6	1975	1.5	1.0	1.0
1976	3.0	2.4	2.6	1976	1.5	0.9	1.0
West Java:				East Java:			
1971	2.8	2.8	2.8	1971	2.0	2.0	2.0
1972	2.7	2.7	2.7	1972	2.0	1.9	1.9
1973	2.7	2.5	2.5	1973	1.9	1.6	1.7
1974	2.6	2.3	2.3	1974	1.9	1.3	1.4
1975	2.5	2.1	2.2	1975	1.8	1.0	1.2
1976	2.5	1.9	2.0	1976	1.8	0.9	1.1
Central Java:				Bali:			
1971	2.1	2.1	2.1	1971	2.4	2.4	2.4
1972	2.1	2.0	2.0	1972	2.4	2.2	2.3
1973	2.1	1.9	2.0	1973	2.4	1.9	2.0
1974	2.1	1.8	1.9	1974	2.4	1.5	1.7
1975	2.1	1.6	1.8	1975	2.4	1.2	1.5
1976	2.1	1.5	1.6	1976	2.3	1.0	1.5

President Soeharto is widely respected and revered by large portions of the population, and his emphatic messages are taken to heart. Soeharto stresses family planning as an integral part of the Indonesian "Code of Ethics" which states that belief in God, Nationalism, Humanity, Democracy, and Social Justice are the five pillars on which people should base their lives. The government's commitment is also reflected in its flexible programming and widespread acceptance and use of international population assistance.

Commitment by government leaders and availability of international assistance alone cannot effect the desired change, however. In Indonesia, cultural and religious beliefs have had a positive effect on contraceptive use at the community level. Traditional Islamic religious law or "Adat" is a strong behavioral influence on Muslim people. When the government instituted its national family planning program there were fears that contraception would conflict with the law of Adat for Javanese Muslims. But the Koran states that "all of God's children must be cared for," thus providing an underlying admonition to have only wanted births. Islamic leaders and "Klian" members (village elders) have publicly endorsed contraception as a means of preventing unwanted births which thereby enables families to better provide for children already living. Traditional Islamic values constrain the use of certain methods because of their modes of administration. According to the Koran, any public display of the genital area renders one "malu" or "shamefully embarrassed" which poses problems with IUD insertion. The fear of malu is especially strong among rural Muslims on the outer islands where peer influence is most important. Since most doctors in Indonesia are male, a woman using an IUD would almost certainly be considered malu. Interestingly, this fear is unknown in Bali, where Hindu tradition imposes no such threat. The pill has consequently been the favored modern method in Java while the IUD has gained widest acceptance on Bali.

Bali is a unique example of an area where the family planning program has been woven into the island's cultural fabric through the use of strongly structured existing institutions to promote contraceptive behavior. For centuries on Bali there have been organizational divisions within villages, called "banjars." The banjars, which have been trusted foundations of local government for hundreds of years, are also effective mechanisms for social change. Since 1974, as part of the village family planning program, these units have been responsible for encouraging and monitoring family planning services and use. Each village has from 5 to 10 banjars; each banjar contains up to several hundred nuclear families. A good deal of agricultural work is performed collectively by banjar members for the benefit of the entire community, which defuses much of the argument that a family needs many children in order to increase its labor force.

No one factor can be cited as the key to the successes experienced in Indonesia. Socioeconomic development and higher age at marriage undoubtedly played important roles. The islands of Java and Bali may also have been ripe to embrace the notion of limiting their numbers by the visible evidence of population pressures present in a crowded city like Djakarta or within the confines of a small island like Bali. Generally speaking, family planning measures were made available, found acceptable and desirable, and their use was not disruptive of people's day-to-day lives.

Based on its swift national success, the government of Indonesia has shortened the time span during which it hopes to reach its 1970 goal of a 50 percent reduction in fertility: the deadline date is now 1990 instead of 2000. Since 1979 the government has also professed a "beyond family planning" philosophy, which includes incorporating family planning efforts with nutrition and other development services through integrated programs at both administrative and field levels. Vigorous efforts to recruit new contraceptive users and maintain current usage levels are continuing.

Although the elements of Indonesia's family planning success cannot be neatly diagramed for replication in other settings, the high priority given by the government to providing Indonesians with both the motivation and the means to limit their fertility has clearly been a powerful influence.

Appendix B references

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Appendix C

Record Population Growth Persists in Kenya

In 1966 Kenya became the first country in sub-Saharan Africa to officially recognize the effects of rapid population growth on social and economic development. Although various private organizations had been providing family planning services without official consent for more than a decade, it was not until the 1966-70 5-year development plan that the government called for a reduction in the rate of population growth and the increased availability of family planning services at its hospital and health centers. Forty such clinics had become operational a year later.

Because the official aim was to reduce infant mortality and provide voluntary family planning services, no growth or birth rate targets were set, but ensuing 5-year development plans (1970-74 and 1974-78) increasingly emphasized the role of population growth in meeting long-term development goals. The most recent plan called for a reduction in the growth rate to 3.3 percent by 1980. Yet Kenya's current growth rate of close to 4 percent is now the world's highest. Its continuation would result in a doubling of the country's population within 18 years.

A 5-year $40 million integrated Maternal and Child Health/Family Planning Program was a major focus of the 1974-78 development plan. It was designed to promote maternal and child health and strengthen the entire health delivery system in support of the government's position on the relationships between reductions in child mortality and morbidity and reduced fertility (4). The current 1979-83 development plan, which continues to recognize population growth as a major development constraint, for the first time incorporates recently gathered population data in efforts to deal with such problems as urban to rural migration, unemployment, and economic growth.

Kenya's President Daniel Arap Moi, unusually outspoken on the subject of his country's rapid population growth, has set a target of 4.7 children per Kenyan family by 2000. Although the country's leaders have cautiously proclaimed their support, a wide range of cultural factors stand in the way of a rapid deceleration in Kenya's population growth rate.

National and international assistance

Large dollar amounts ($9.8 million in 1978) from a multiplicity of external sources have been spent for population assistance to Kenya in recent years. Twenty-four separate donors designated funds for a variety of family planning activities between 1967 and 1977; the major donors and areas of assistance are shown in table C-1. The Government of Kenya has also contributed substantial sums of its own—approximately $2.5 million in 1978—to family planning efforts. The 1974-78 development plan, as table C-2 demonstrates, was the watershed period for coordinating national and external population assistance in

Table C-1.—External Assistance to Kenya; Functional Support by Agency, 1967-77

	Purpose			
	Research	Training	IEC	FP services
Multilateral				
UNFPA	X	X	X	X
WHO	X	—	—	—
UNICEF	—	—	—	X
World Bank	X	—	X	X
Bilateral				
United Kingdom	X	—	—	X
Denmark	—	X	—	X
Germany	—	—	—	X
Norway	—	—	—	X
Sweden	—	X	X	X
AID	X	X	X	X
Nongovernment				
AVS	—	—	—	X
FPIA	X	X	X	X
IPPF	—	X	X	X
WFS	X	—	—	—
YMCA	—	—	X	X
World Neighbors	—	—	X	X
OXFAM	—	—	—	X
Ford Foundation	X	—	—	—
Rockefeller Foundation	X	—	—	—
Pathfinder Fund	—	—	—	X
Population Council	X	X	X	X

SOURCE: UNFPA, Kenya, Report of Mission on Needs Assessment for Population Assistance Report No. 15, June 1979.

Table C-2.—Development Plan, 1974-78

Source of assistance	Millions	Purpose
Government of Kenya . .	$14.3	Personnel, operations, capital, research
World Bank	12.0	Construction of centers vehicles
Sweden	5.4	Training, construction, salaries
AID	3.6	Personnel, training, commodities
UNFPA	3.5	Advisors, equipment, research
Germany	0.9	Training
Denmark	0.6	Training
Total	$40.3	

SOURCE: Office of Technology Assessment.

Table C-3.—External Dollar Flows for Population to Kenya by Agency, 1977-78 (in thousands)

	Bilateral		Multilateral			
	United States	Other MDC	UNFPA	IPPF	Other NGO	Total
1977	$1,161	$4,114	$1,112	$ 843	$ 278	$7,508
1978	$1,341	$3,702	$ 658	$1,160	$2,927	$9,788

SOURCE: UNFPA Fact Sheets, 1977, 1978.

Table C-4.—Sectoral Breakdown of Population Assistance to Kenya, 1977-78 (in thousands)

	Family planning services	IEC activities	Training and research	Population policy	Data	Total
1977	$7,121	$174	$ 67	$ 0	$ 80	$7,508
1978	$9,389	$ 63	$139	$19	$188	$9,788

SOURCE: Office of Technology Assessment.

initiating Kenyan population and development efforts.

AID has contributed substantial amounts to Kenya's program through bilateral funds and nongovernment intermediaries. Family Planning International Assistance (FPIA) has worked with Kenya's Ministry of Education in developing family planning educational materials, and the Association for Voluntary Sterilization (AVS) has provided surgical sterilization equipment for women, to cite two examples. The largest private donor has been the International Planned Parenthood Federation, (IPPF) which in 1979 contributed $994,000.

International population assistance to Kenya in recent years has resulted in substantial per capita totals. During calendar year 1977 Kenya received 47 cents per person from international donors, an amount which rose to 61 cents per person in 1978—one of the highest per capita amounts ever given to an LDC (see table C-3).

The data in table C-4 illustrate the extent to which external assistance has focused on family planning services during the last few years. These services have included contraceptive supplies, delivery systems, and, in some cases, funding for health clinics and salaries for personnel.

Despite a continuing large flow of dollars into the country and a high level of cooperation and coordination among donors, little progress in reducing birth rates has been made during the 13-year span of official government efforts. The attention of both external donors and the Kenyan government has now begun to focus on the disparity between the actions thus far taken to curb the country's population growth and the results obtained.

Effect of family planning program

By the end of the 1974-78 Development Plan, there were 505 integrated maternal and child health/family planning clinics in operation. Although the cofinanced, integrated program had expanded the number of clinics, because of Kenya's infrastructure and development planning problems they were unevenly distributed throughout the country and women were often required to travel great distances to obtain contraceptive supplies. The Government's original targets for establishing contraceptive use had not been met and had to be readjusted. The dropout rate was very high: only 18 percent of women who began using oral contraceptives in 1967 were still using them 1 year later. The reasons most often cited for Kenya's program failures were the inadequacy and unavailability of services, and a lack of demand for supplies and services.

Clearly, national and international interventions to reduce birth rates have not yet been effective. In 1965 the birth rate was 50.2; by 1980 it had dropped only to 49.0. The contraceptive prevalence rate of 9 percent is unusually low for a country with an established population policy, a longstanding family planning program, and a substantial inflow of population assistance funds.

Data from the World Fertility Survey (WFS) reveal that today's generation of women of reproductive age are having as many children as their mothers did. The total fertility rate in 1969 was 7.6 births per woman. In 1980 this rate among married women of reproductive age in Kenya had risen to 8.1, a current world record. An unusual aspect of this high fertility was revealed by the 1977-78 Kenya Fertility Survey, which found that 90 percent of these births were desired by the mothers. Only 17 percent of female respondents said they wanted no more children; the comparable average from WFS countries is 50 percent.

Photo credit: World Bank

Family planning instruction is part of the regular routine at Machakos Hospital, Kenya

The country's high birth rate has also persisted despite a reduction in infant mortality. This decline in infant deaths has increased Kenya's dependency burden; half of the population is now younger than 15 years of age. If the present birth rate continues, the number of dependent primary-school age children (6 to 13), which in 1975 was 2.6 million, would reach 8.5 million by 2000. The rapid rise in numbers of Kenyan children is shown in figure C-1.

Development activities have historically been weak in Kenya, but the political and cultural pressures that motivate people to have children appear to play a central role in Kenya's persistently high growth rate.

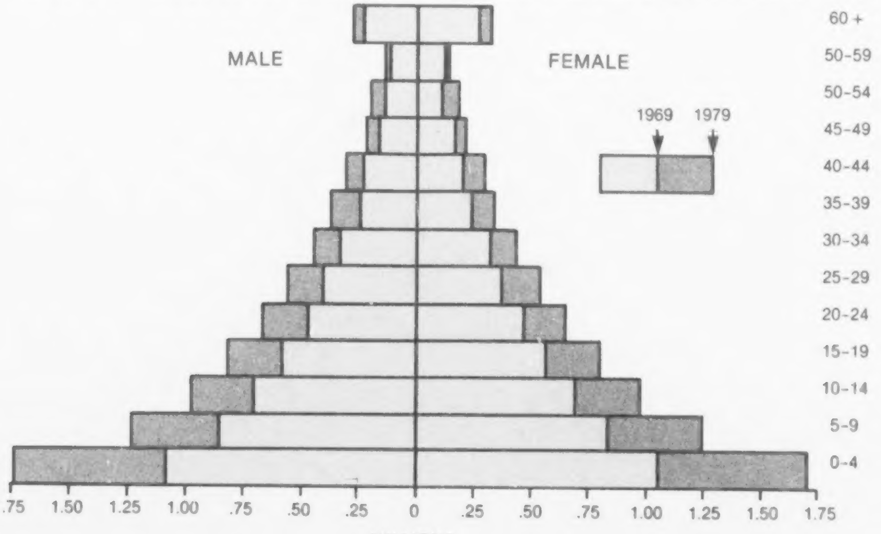
Influence of cultural and political factors

The cautious tone that pervaded official Kenyan response to early offers of foreign population assistance stems from the country's closely connected culture and politics, and the omnipresent strength of tribal loyalties. The Kikuyu and Luo tribes, which dominate the political scene and set national policy, have often been accused of promoting family planning to reduce the numbers of rival tribes while maintaining an "undeclared" pronatalist policy for their own people. While disclaimers abound, a tribal "pecking order"—a kind of caste system—in which overall strength is judged by sheer numbers of people, appears to prevail. The Kikuyu and Luo have two of the highest overall growth rates of Kenya's major tribes.

It is generally agreed that people in LDCs, as elsewhere, despite government proclamations and pressures at the community (or tribal) level—whether pronatalist or antinatalist—tend to try to do what is best for themselves. In Kenya it still appears to be in the best interest of the individual to desire, and produce, a large family.

Eighty percent of the people still depend on agriculture for their livelihood, and women are faced with most of the field work and all of the household chores. The rural women's workload has tradition-

Figure C-1.—Kenya's Population Age Structure in 1969 and as Estimated for 1979



SOURCE: Mott, F. L. and S. H., "Kenya's Record Population Growth: A Dilemma of Development," *Population Bulletin*, vol 35, no. 3, October 1980.

ally risen when husbands and older sons migrated to follow crop seasons or to find grazing lands for herds. Now economic development and increasingly scarce agricultural land are also drawing rural Kenyans to urban and cash crop areas in search of jobs.

Men continue their almost total domination of Kenyan political and social life, and some one-third of all marriages are still polygamous unions. Because few Kenyan women have access to paying jobs outside the home, status for women can generally be obtained only through the political, occupational, or family status of their husbands, or through their children. Thus large numbers of children not only give a woman more helping hands but increase her status in the eyes of her husband. Having a large family can both ease a woman's overall workload and (in the case of smaller tribes) increase the probability of offspring marrying into a tribe with greater political and economic strength. When her husband precedes her in death (Kenyan women on average live longer than men), she must depend on sons for support because land is nearly always passed through the male line. To be sure that her children are old enough to support her when she becomes a widow, it is to her advantage to marry and begin childbearing at an early age. The average age at marriage of rural women surveyed in the Kenya Fertility Survey was between 17 and 18.

A recent bill that would have given wives in polygamous unions equal property and inheritance rights was soundly defeated in the Kenyan Parliament, where it was denounced as un-African and culturally unacceptable. In short, from the individual perspective, there appears to be little reason for a rural Kenyan woman to want to limit her family size, given her need to labor in both field and household, her hope for security in old age, and her desire for social status.

This picture may be changing for particular groups of women, however, as lower fertility rates have recently been noted among more educated women and those residing in the urban areas of Nairobi and Mombasa, where there are fewer barriers to acquiring contraceptive information and services. But women who live in cities or who have secondary educations are a very small proportion of the total population: only about 12 percent of the women covered in the Kenya Fertility Survey had gone beyond 8 years of school. Although girls have gained significantly in recent rises in primary school enrollment, they remain far less likely to attain the secondary school level, where educational gains translate into significant fertility declines. Their involvement in modern employment is also negligible, and the pace of their entry into nontraditional jobs is expected to be slow, as opportunities will fall far short of the large numbers of young women entering adulthood.

The demographic objectives of the current 1979-83 National Development Plan again stress the government's intention to reduce Kenya's rate of population growth, and to work toward bringing the age structure into balance by 2000. Encouragement of child spacing and reduction of infant mortality are family planning program priorities. The government has also concluded that information, education, and communication activities must be expanded beyond the realm of the Ministry of Health. Kenya's leaders are now voicing the belief that future population assistance and family planning programs will have to take greater account of fertility-related attitudes and the role of women in the family planning decisionmaking process.

Yet the extent to which these factors can realistically be addressed in Kenya is a controversial topic. The importance of recognizing individual needs in the structuring of Kenya's development programs is clear, but the momentum of today's record-breaking growth rates is likely to substantially delay the achievement of the country's development goals.

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Appendix D

Production and Distribution Capabilities for New Fertility Planning Technologies Over the Next Two Decades[*]

Introduction and conclusions

This section reviews the interrelationships between changes in the manufacture and distribution[**] of current and new fertility planning technologies and their availability in less developed countries (LDCs), and looks at the ways in which production and distribution will influence the development of new technologies.

These impacts ultimately influence the cost, formulation, design, and ease of supply and resupply of the contraceptive technologies to be distributed by government programs in LDCs. Many agencies and organizations in addition to the government agencies directly responsible for distributing the relevant technologies significantly affect and are affected by manufacturing and distribution decisions. These include ministries of trade, labor, industry, and finance in LDC governments, as well as international donor agencies, technical assistance agencies, and manufacturers. Other agencies are peripherally involved; these include those responsible for setting manufacturing and quality control standards, for regulating drugs and devices, and for supplying manufacturing equipment.

The following pages provide a qualitative consideration of the likely courses of events over the next 20 years in the production and distribution of fertility planning technologies. More extensive research would be necessary to accumulate quantitative information.

Several conclusions have been reached about the evolution of family planning programs and the development of new technologies over the next two decades:

1. Many of the prospective fertility planning technologies (silastic implants that release steroid hormones, biodegradable implants, injections that utilize hormone-carrying polymers, silastic vaginal rings) will require the creation of new manufacturing capacities for their widespread distribution. No similar technologies, either for fertility planning or for other purposes, are currently being marketed in large scale. This requirement for new manufacturing technologies may:
   - a) increase the time required for new products to become widely available;
   - b) increase the dependency of the public sector on the private commercial sector (located mainly in more developed countries (MDCs)) for establishing the capability to manufacture the new technologies;
   - c) make it increasingly difficult for most LDCs to establish local production of new technologies; and
   - d) enlarge the role of international donor agencies and MDC manufacturing companies in determining the kinds of technologies that will be available to LDCs.
2. Other constraints to the introduction of products may be of more importance for the availability of new or improved methods than possible limitations in manufacturing. Because introduction of a new product into a family planning program is expensive, time consuming, and can lead to disruptions in the program, program managers need substantial justification for its introduction. The most important justification is that the new product will result in a significant new increase in contraceptive use.
3. There is a trend in a number of the most populous LDCs toward government sponsorship of local production of fertility planning technologies. The impetus for this trend often comes from

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[*] This summary is drawn from a report prepared for OTA by Richard T. Mahoney of the Program for the Introduction and Adaptation of Contraceptive Technology. The development of new fertility planning technologies and increased demand for contraceptives will require extensive changes in systems of manufacturing and distribution. The effects of these changes will be significant in both LDCs, where governments will need to examine their capability to provide commodities in the context of moving toward self-sufficiency in their family planning programs, and MDCs, whose roles in providing future population assistance are likely to be substantially altered.

[**] Distribution here refers to the processes and routes whereby contraceptives arrive in the hands of users from their initial point of manufacture. While this includes distribution from receiving points for supplies at the commodities headquarters of LDC family planning programs to clients of such programs, the major focus of this paper is on distributing mechanisms and channels that precede this point in the supply chain.

high government levels—the president, prime minister, or cabinet—rather than from donors or officials of the family planning program itself.

4. Those LDCs that do establish local production may be limiting their access to future improved versions of the technology. This is true not only because of the difficulties in "retooling" a manufacturing facility (to switch from an "older" to a "newer" version of an IUD, for example) but also because access to the new technology may be constrained by patents and licenses. An LDC may find it prohibitively expensive to acquire the production know-how and licensing necessary to manufacture the improved technology, and thus opt to stay with the "older" version of the method.
5. As a corollary to conclusion 4, LDCs that do not establish local production of a particular method may be enhancing their future access to modifications and improvements of that method. Further, the levels of product use they can achieve will permit them to request, for very little additional cost to the donor or themselves (depending on whether the commodities are donations or purchases), "customized" products* to fit their particular needs. These LDCs will, however, continue either to be dependent on donors for their commodity supplies or will have to use hard currency to purchase products on the international market. These considerations, and others, could lead some countries to the conclusion that local production is the more desirable course to pursue.
6. The eight large multinational firms that manufacture most of the world's contraceptives will continue to play an important role through the year 2000. These firms will probably be responsible for manufacturing products for use by nearly one-half of the population of the developing world. Local production in the LDCs with the largest populations (such as India, China, and Indonesia) may meet the needs of the other half.
7. For economic reasons, if family planning programs are to have adequate supplies of commodities, the large bilateral and multilateral donors (the U.S. Agency for International Development (AID) and the United Nations Fund for Population Activities (UNFPA)) will need to remain active in commodity procurement through 2000. However, they will be likely to diversify the commodities they provide in response to requests from LDCs for products more suited to their individual social and cultural needs.
8. The two major international aid agencies have taken similar policy stances on procurement of commodities and local production although UNFPA has given slightly greater emphasis to the latter. UNFPA has been directed by its Governing Council to provide logistic support, including contraceptive commodities, if required and to encourage, where appropriate, the local production of contraceptives. AID's program is under continual review but currently gives preference to the supply of commodities. AID takes the view that the development of local production facilities must be considered in the context of the total aid commitment to the particular country and to the needs of the country. If the total aid package and the need for local production are compatible, AID will support local production.
9. It seems unlikely that many LDCs will procure products produced by government-owned or private locally-owned factories in other LDCs.

Manufacturing constraints to the development and supply of future technologies

Because few radically new** fertility planning technologies are expected to be made available in the next 20 years, most manufacturing and distribution efforts will focus on existing technologies and the modifications of these technologies likely to be introduced within the next decade (see ch. 5).

Radically new technologies are likely to reach only the stage of prototype manufacture and large-scale field testing by 2000. If the major clinical and laboratory studies of these contraceptive technologies now under way demonstrate their safety, efficacy, and acceptability, they would be ready for introduction to national family planning programs. Preparations for the introduction of subdermal silastic implants are already being launched by the Population Council and the Rockefeller Foundation in several LDCs.

But before any of these methods can be introduced on a large scale, mass production facilities to provide adequate supplies must be established. Because each of these technologies, as a technology per se, is relatively novel, the startup time for its large-scale manufacture would be considerably longer than that required for a new pill, for example.

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*Products utilizing special packaging or presentations to meet local needs

**"Radically new" is used here to designate those contraceptives under development or that will be discovered that would represent a fundamentally different biological means of contraception than those technologies currently available. For instance, a hormonal injectable contraceptive for men would be radically new, whereas a new hormonal injectable for women would not.

Thus, the early large-scale manufacture of these contraceptives is likely to be carried out by large multinational pharmaceutical firms in MDCs, which have the expertise, facilities, and resources to launch the production of a new product in a comparatively short period.

Public sector family planning programs already rely heavily on large contraceptive manufacturers in MDCs, and the advent of improved methods appears likely to continue this dependence. This analysis examines some of the consequences of this dependence, but an in-depth evaluation of its costs and benefits would clearly be useful.

Richard Buckles (2) contends that the public sector has paid insufficient attention to the production component of making new contraceptive technologies available. He believes that research and development organizations should work out full-scale plans for how, where, at what cost, and with what personnel new technologies are to be produced. Public sector development assistance agencies are generally not prepared to undertake such production, he points out, and are doing little to become more effective partners with industry in making new methods available to national programs.

Distribution system constraints to the availability of new technologies

The introduction of a new technology can have great impact on a government family planning program. Although it is possible for a national program to introduce and distribute new technologies in a fairly short period, experience indicates that to do so is likely to lead to severe damage to the program, and there is growing recognition of the need for careful planning prior to the introduction of a new technology.

The sheer inertia of large bureaucracies can lengthen the interval needed for introduction of a new technology. For example, even though the Copper T IUD was developed in the mid-1970's, very few family planning programs have yet introduced it for widespread use.

The introduction of a new "improved" technology, such as an oral contraceptive or IUD, into a national program can take from 2 to 5 years. In most cases, the introduction process can be expected to take even longer.

The systematic introduction of a new technology involves a number of major steps:

1. Obtaining the approval of the body responsible for distribution, such as the ministry of health.
2. Obtaining the approval of the local drug regulatory agency.
3. Identifying a donor agency willing to provide continuous supplies, or establishing local manufacturing capabilities.
4. Conducting and analyzing studies on product acceptability among the target populations.
5. Determining the qualifications of personnel approved to distribute the product and implementing training programs.
6. Developing training materials for service providers.
7. Designing and implementing motivational and promotional campaigns.
8. Establishing physical distribution, storage, and warehousing procedures.
9. Designing and implementing monitoring programs to evaluate product performance.

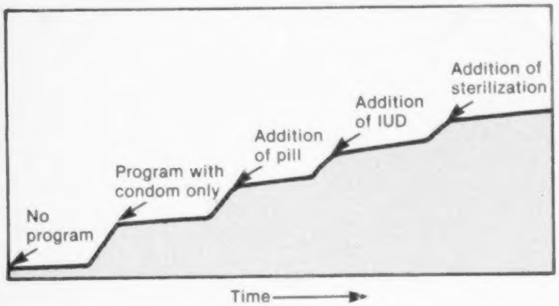
In order to carry out these steps, numerous institutional, financial, and individual resources need to be marshaled. They include those of the relevant offices in the ministry of health, the local drug regulatory body, donor agencies, university or private research groups skilled in market research, the medical community, university or private groups skilled in the development of information, education, and communication materials, and university or private research groups skilled in program evaluation. Completion of these steps is obviously time consuming and can inhibit the introduction of new technologies.

Program managers in LDCs are likely to want substantial justification for the addition of a new technology or the replacement of an old technology. The likelihood that an IUD will reduce bleeding among users may be insufficient reason for its introduction if it offers no other advantages or has concomitant disadvantages such as short lifetime or high price. Although a new sterilization procedure may be faster and easier to perform, it may not be introduced if it requires retraining of the entire medical staff providing the program's sterilization services.

An oft-stated reason for introducing a new technology is that it will provide an alternative for users of currently available methods. This argument is based on the net increase in contraceptive use commonly observed when a program introduces a new method. The incremental increases in contraceptive use experienced by a typical family planning program can be seen in figure D-1.

Program managers realize that the introduction of a new or modified method with clinical advantages over currently used methods can result in increased contraceptive use, but express concern about wheth-

Figure D-1.—Prevalence of Contraceptive Use



SOURCE: G. Perkin and L. Saunders, "Extending Contraceptive Use," PIACT Paper, no. 5, 1980.

er the new method can attract sufficient additional users to justify the costs, in both financial and institutional terms, of adding the product to the distribution program.

An example is the use of the injectable contraceptive Depo-Provera in Thailand, the country most often associated with program use of this method. The government has not moved aggressively to expand distribution of Depo-Provera, which has never been used by more than a few percent of all users, for several reasons, including the international controversy that surrounds this product because of the Food and Drug Adminstration's (FDA) lack of approval for its use as a contraceptive by women in the United States. A major factor is the relatively more complicated and expensive logistical cost of Depo-Provera distribution compared with that of pills and condoms. Depo-Provera is roughly equal in purchase price to the pill in terms of duration of protection but requires either that mobile teams of doctors, nurses, or midwives visit users on a regular basis, or that the user herself return to the distribution center for a new injection. Oral contraceptives have their own logistical problems, but the additional problems of Depo-Provera have inhibited its broader distribution in a country where its safety and acceptability are widely recognized.

The development of new or improved fertility planning technologies is clearly a matter of high priority. It should be recognized, however, that the development of a method that has statistically better efficacy rates than presently used products will not naturally lead to the introduction of that product to family planning programs. The new or modified product could well remain a little-used product. Thus, in setting priorities for fertility planning technology research, giving priority to those that promise to reach significant new groups of potential users—such as men—is extremely cost effective as such products are likely to have the greatest comparative appeal to program managers.

To produce locally or not to produce locally

There is a definite trend toward the establishment of government-sponsored fertility planning technology production facilities in LDCs. Among the countries that have developed major capacities to meet their own needs in the past 10 years are Indonesia (pills), India (condoms, IUDs, and pills), Egypt (pills and IUDs), and the People's Republic of China (condoms, pills, IUDs, injectables, barrier methods, and abortion and sterilization methods).

When an LDC government takes an active role in facilitating the establishment of local production of fertility planning technologies, policymakers at the highest levels, often the president or prime minister, are apt to be involved in the decision. In several Asian countries, the push for local production has come not from the relevant program bureaucracies, but from top government officials. The Office of the President in Indonesia and the Office of the Minister of Economic Planning in the Philippines were highly influential in the decision to consider establishing local production of contraceptive technologies in those countries.

Unlike many other new developments in family planning programs, this trend toward establishing local production has been instigated by decisionmakers within the country, often in the face of lack of support or opposition from donor agencies. The reasons for this trend toward local production are as yet unclear, but several observations can be made.

First, the decade of the seventies saw the formalization and implementation of government commitments to family planning, and most governments are now committed to either directly providing or permitting others to provide contraceptive technologies to their people. As these programs grew, it became apparent that the potential market for contraceptive products is very large compared to the markets for almost all other health products for whose distribution the government takes primary responsibility. Contraceptives are provided to healthy couples during a potential three decades of their lives. In most LDCs, healthy, fecund couples constitute some 15 percent of the total population. In a moderate-sized LDC of 50 million, the number of eligible couples would thus be about 7.5 million. If family planning programs were to reach their goal of up to 70 percent use of contraceptive products, the likely totals of product units are impressive. If in this hypothetical population of 7.5 million eligible couples an average of 5 million were to be continuing users, and of these users, 25 percent each were to use the pill and IUD, 15 percent to use the condom, 30 percent to be sterilized, and 5 percent to use other methods (with moderate continuation rates), the demand for contraceptive products would be as follows:

Method	*Users (million)*	*Product use per user/yr*	*Total product use/yr*
Pill	1.25	13 cycles	16.25 million
Condom	0.75	100 condoms	521,000 gross
IUD	1.25	0.5	625,000 IUDs

At current world market prices for these products the approximate value of this use would be:

	Unit price		*Total value of product used (millions)*	
Method	*Public sector*	*Private sector*	*Public sector*	*Private sector*
Pill	\$0.19/cycle[a]	\$3.50/cycle[b]	\$3.09	\$56.88
Condom	\$4/gross[a]	\$14/gross[b]	2.08	72.94
IUD	\$0.50 each	\$7 each[b]	0.32	4.38
Total			\$5.49	\$134.20

[a] Current AID price including freight.

[b] These are approximate averages of private sector wholesale prices. Substantial variations exist among countries.

These amounts are impressive when compared with the total health procurement budgets (exclusive of fertility planning technologies) of most LDCs. For example, the health procurement budget for the Philippines for 1980 was set at \$20.5 million. Its population of approximately 45 million implies (by the above calculations) contraceptive technology procurement of approximately \$4.9 million at public sector prices. (At current levels of use the actual supply plans of AID to the Philippines average \$4.5 million per year for the next 4 years.)

On a worldwide basis, these costs constitute an important limitation to the introduction of new technologies. As S. Bruce Schearer of the Population Council notes:

> Cost will be a significant obstacle to uptake and use of the new technologies . . . Will foreign assistance agencies be able to keep footing the bill for establishing new manufacturing (capacities) and paying for an increasing variety of technologies, some of which will probably be more expensive, for an ever-increasing number of acceptors for the next 20 years? Hundreds of millions of dollars are likely to be required for all these commodities, one way or the other. Where will this come from . . . ?

These calculations, when carried out by decisionmakers in LDCs, are likely to lead them to several conclusions: maximum control over the allocation of resources of these magnitudes is desirable, as is the avoidance, wherever possible, of paying commercial prices for products. Even though public sector prices can be obtained by relying on commodities assistance from international agencies, LDC decisionmakers would not like to find themselves in a permanent position of having a program of major importance to their country's well-being totally dependent on foreign donors for supplies of the commodities necessary for continued program operation.

Donor agencies have carried out similar calculations. Recognizing the valuable role they play by procuring contraceptives at low public sector prices to LDCs, AID, the International Planned Parenthood Federation (IPPF), UNFPA (via UNICEF), and other donors make commodity procurement and supply important components of their assistance programs. In order to obtain the lowest possible prices, some donor agencies procure uniformly packaged products with little product variation (dosage, design, etc.). Another factor favoring low prices is that manufacturers need incur no marketing costs, or costs of negotiations with regulatory agencies in the recipient countries, which are handled by the donor.

Private manufacturers have also examined these market trends and have concluded that concessional supply of contraceptives to public agencies is an economically attractive alternative to direct private-sector marketing for the huge low-income, little-developed markets of potential users in LDCs. They have determined that if they subtract all costs related to product merchandising and concentrate solely on manufacturing costs, they can sell products to public programs at low prices and still make a reasonable profit. They have thus been willing to become full participants in the current three-party arrangement for supply of contraceptives to public programs that prevails in most LDCs.

This three-way partnership is not, however, fully stable because of the differing views and needs of different participants. For example, the two public sector donor agencies most involved in commodities procurement, UNFPA and AID, have somewhat dissimilar views on meeting the need for public sector support of commodities. Aid, through Joseph J. Speidel (4), Acting Director, Office of Population, has stated:

> . . . Since AID's ability to provide support for contraceptive commodities is dependent on annual appropriations for this purpose, a long-range policy must be subject to continuous review. However, AID does not at this time intend to alter previous policy regarding contraceptive supply and our planning includes provisions for the continuation of these efforts.

At present, AID provides grant-funded orals and condoms to all bilateral and grant programs except Indonesia, the Philippines, and Thailand. The Office of Population has discouraged use of loan funds for family planning commodity programs, but there is no firm AID policy on this issue. Because a part of population funds must now be used for loans, there is a tendency for some AID missions to urge a switch to loan funding for contraceptive purchases. However, most countries resist this change and it is anticipated that the current practice of grant funding will be continued in most countries.

The following amounts were spent by the Office of Population for contraceptive commodities during the years 1975-81 (4).

Year	*Amount (rounded) in millions of dollars*
1975	$24
1976	36
1977	27
1978	23
1979	43
1980	34
1981	39

These amounts average approximately 20 percent of the total budget of the Office of Population.

AID appears, in the absence of new policy determinations to the contrary or a lack of funds, to intend to continue the provision of commodities to family planning programs into the foreseeable future. However, along with other donors, it will continue to review its policy in order to ensure adequate supplies of contraceptive commodities to LDC programs.

The UNFPA governing council at its meeting on June 23, 1981 (6) confirmed that support of family planning will be its first priority. Family planning efforts oriented towards the individual and the family will include programs integrated with maternal and child health services in the primary health care context and in other programs as appropriate to social and cultural conditions as well as:

- delivery of services at the community level, including improvements in the logistical systems through which such services can be provided;
- training of personnel;
- strengthening of management;
- logistics support including provision of contraceptives, if required;
- encouragement, where appropriate, of local production of contraceptives; and
- research into traditional and new contraceptive methods and development of improved means including natural family planning methods.

UNFPA will thus support both commodity procurement and local production of contraceptives where appropriate.

In commenting on local production, Speidel noted that:

> While AID has no "policy" so far as local production is concerned, such efforts must be undertaken with caution since the Agency's experience with such ventures is not encouraging. The rate of population growth is important to development. As an agency, it is our policy to assist in the reduction of the rate of population growth by providing cooperating governments with contraceptive supplies. Local production of contraceptive commodities puts one into another area of economic development, and that is the development of local industry, the provision of jobs, and the transfer of technology. These elements of economic development should be reviewed in the context of other possibilities for the expansion of industry, as well as in the context of family planning programs.

In order to make high quality contraceptive products available in developing countries at little or no cost to the user, AID's purchases of large quantities of these products have made a significant contribution. In the case of some products, however, most notably oral contraceptives, the price obtained by the AID program makes the economics of local production of this product questionable at best without consideration of other factors. The price paid by AID has increased approximately $0.04 per cycle since 1974 and is currently less than $0.18. When one considers the retail price in the United States has risen from around $3 to $8 per cycle during this same period of time these savings to program costs are even more striking. The lack of profitability this price differential provides for local production will tend to discourage these developments at this time. In addition, local production of oral contraceptives is only possible for packaging and tableting. Synthesis of raw materials is not practical. Dependence on local production is likely to create problems relating to locked-in technology, protectionist import policies, low quality, and uncertainty of supplies.

In this context, it should be noted that AID has assisted the Government of Indonesia in establishing local production of oral contraceptives by supplying raw materials and providing technical assistance. However, Indonesia represents a very large market and was the first country to accept, in principle, commodities on a loan basis.

Very little rigorous research has been conducted to assess the economic feasibility of local contraceptive technology production in LDCs. Although it is widely believed that it costs substantially more to produce contraceptive products in LDCs than in such MDC factories as those of Akwell and Syntex, two major AID suppliers, a recent Program for the Introduction and Adaptation of Contraceptive Technology (PIACT) study tends to cast doubt on this assumption (6). Carried out at the request of the Government of the Philippines, the study extensively detailed the economic feasibility of condom production in the Philippines. It gathered information from equipment suppliers in Japan, the United Kingdom, and the Netherlands, and calculated the costs of latex, packaging materials, chemicals, miscellaneous supplies, electricity, space, labor, taxes, import duties, etc. The study made a thorough analysis of the potential demand in appropriate relationship to both the government family planning program and the private sector market.

A summary of the study provides a useful comparison of the cost to the U.S. Treasury of placing one condom in the hands of a Filipino man through 1) a grant by AID; and 2) through AID supporting all the costs of building and running a condom factory in the Philippines. Using 1980 costs, these two figures are $0.039 and $0 036, respectively, or a savings of $0.003 per condom following the local production route using accepted practices of amortization of capital costs. The local production cost includes the value of the customs duties and/or taxes that the Philippine Government would normally levy on machinery and materials for condom production. If the Philippine Government were to waive these duties and taxes, the net cost per condom would be reduced to $0.027 or a reduction of 33 percent over grant-provided commodities.

PIACT has also carried out a preliminary assessment of the feasibility of local production of oral contraceptives in the Philippines, which is to be followed by an in-depth evaluation comparable to that carried out for condoms. The preliminary study provides approximate figures from which conclusions can be drawn about the feasibility of local production. Using the comparison analogy of the previous paragraph, the AID procurement route would cost $0.188 per cycle of oral contraceptives including freight and insurance in 1981, and the local production route would cost approximately $0.20.

The economic feasibility of local production of oral contraceptives has been recognized by many of the larger LDCs and by multinational pharmaceutical firms. As is detailed later, most larger LDCs have local production of oral contraceptives either in government plants or factories of multinational pharmaceutical firms.

The PIACT calculations for condom and oral contraceptive production were designed to be readily adapted to the situation in other LDCs; it would appear that in countries similar in population size to the Philippines the costs would be comparable.

The question of UNFPA and AID support for the establishment of local production is really one of allocation of scarce resources for population assistance to LDCs. In order for family planning programs to operate, they must have access to contraceptive technologies that couples can use. These technologies can be provided by donors in two ways: through donations or through support of local production. It seems logical that if outlays of financial resources for these two options are comparable, local production deserves serious consideration and, in some situations, implementation, particularly in consideration of the adage that it is better to teach a man to fish now than to give him free fish forever.

Although the major donors may intend to continue indefinitely to provide commodities where needed, LDCs cannot consider these intentions a guarantee. In some LDCs, local production may fill the need for the reliable, continuing sources of commodities necessary for a successful national program.

Local production may never be economically feasible in some LDCs. These countries, especially the smaller ones, will either have to rely on external assistance or will have to identify other means to procure the commodities they need.

At the present time, virtually all contraceptives used in national family planning programs, with a few exceptions (China, India, Egypt), are manufactured by MDC-based multinational drug firms in factories located in both MDCs and LDCs. Virtually all of these contraceptive products are supplied by AID, UNFPA, or, on a smaller scale, the Swedish International Development Authority (SIDA) and IPPF at the request of LDC governments. The major manufacturers providing these products at concessional prices to these agencies are:

Pills	Syntex, Schering, Organon
Condoms	Akwell, Dong Kuk, Sagami
IUDs	Ortho Pharmaceutical, Finishing Enterprises

These eight manufacturers account for almost all of the products used by public programs in countries that do not now manufacture their own supplies. Thus both donors and these major manufacturers have important stakes in the evolution of contraceptive production in LDCs.

The manufacturers are concerned about local production because several of them have developed local private-sector markets in LDCs. Prominent among these are Schering, Organon, and Dong Kuk. Moreover, Syntex and Schering provide raw materials to plants in Indonesia and Egypt, respectively, as two examples, for the production of oral contraceptives. Local production in LDCs would cut into the quantities that donors procure for those same countries, but local production might also stimulate the private sector by enhancing government efforts to encourage the adoption of family planning. On the other hand, production by local governments might cut into private-sector production because the government-produced contraceptives would be cheaper than those produced for the private sector.

Finally, not all manufacturers supplying LDCs also have developed private-sector markets in those same countries, and vice versa. For example, Wyeth does not supply the public sector but sells to the private sector in several LDCs; Syntex sells to the public sector but has almost no private-sector sales in LDCs.

In summary, the influence of the private-sector market in decisionmaking with regard to public-sector production and distribution of fertility planning technologies is difficult to evaluate and varies from country to country. The factor that will most heavily affect the private sector is the strength and nature of the government family program.

The role of the private-sector market in LDCs

Public information about the size and rates of growth of private-sector markets for contraceptives in LDCs is sparse. Studies several years ago showed that most contraceptive use in LDCs was the result of purchase through the private sector (1). Although the relative proportion of contraceptive users supplied through the private sector may have decreased as the reach of family planning programs has extended, their absolute number has probably grown. Many would argue that the growth of family planning programs has been a major contributor to the growth of private-sector sales in LDCs by introducing added numbers of individuals to the use and practice of contraception. As contraception becomes a normal part of their lives, some will move from free or subsidized supplies from government outlets to purchased supplies from the private sector. Others would argue, and quite convincingly, that when family planning programs become significant in coverage, they can cut deeply into the expansion of private-sector markets.

The international manufacturers that have been supplying fertility planning technologies to LDCs thus find themselves facing a complex series of calculations.

The role of locally owned private sector manufacturers in LDCs

Although the production of fertility planning technologies is largely the province of governments and international manufacturers, privately owned factories in LDCs, whose owners are businessmen in these countries, also play a significant role. In Thailand, a locally owned rubber products company manufactures condoms, in the Philippines a locally owned pharmaceutical corporation has been tableting and packaging pills for the local market for several years, a locally owned company in Mexico manufactures IUDs, and a Korean company also manufactures condoms. These companies have, almost without exception, been established to sell products to the private sector, but sometimes supply products to the public sector in their own countries.

It would appear that more serious consideration needs to be given to the role of these companies. In many countries these local resources have not been used because Congress requires AID to purchase U.S.-made products with its funds for commodities. Thus U.S.-made oral contraceptives are imported for use in the Philippines even though a private, locally owned firm manufactures tablets of similar composition.

Current status of local production and implications for donors

The following table lists the 20 most populous LDCs and indicates which of these countries had production capacities (G = government controlled, P = private ownership, (L) = local, (M) = multinational) for oral contraceptives, IUDs, or condoms as of 1980, and which are examining plans (pl) for establishing production of these technologies.

	Method		
Country	*OCs*	*IUDs*	*Condoms*
China	G	G	G
India	G, P(M)	G	G, P(M)
Indonesia	G, P(M)	pl	pl
Brazil	P(M)	—	—
Bangladesh	P(M)	—	—
Pakistan	P(M)	G	pl
Nigeria	—	—	—
Mexico	P(M)	P(L)	P(L)
Vietnam	—	—	pl
Philippines	P(L)	—	pl
Thailand	P(M)	—	—
Turkey	P(M)	—	—
Egypt	G	G	—
Iran	P(M)	—	—
Republic of Korea	P(M)	—	P(L)
Ethiopia	—	—	—
Burma	—	—	—
Zaire	—	—	—
Argentina	P(M)	—	—
Colombia	P(M)	—	—

The local companies are owned by business people in the LDC; some minor amounts of foreign capital may be involved. The multinational companies either export their products to LDC factories for local packaging, or carry out partial or complete manufacture in LDCs using, in both instances, subsidiary or joint venture companies.

The table demonstrates that multinational private pharmaceutical firms have found it economically feasible to establish oral contraceptive tableting and packaging facilities in these countries. (In many of these LDCs the companies have established local production because of national restrictions on the import of finished pharmaceutical products. These firms nevertheless concluded that they could produce locally and profitably—that in fact the local production of oral contraceptives in an LDC can be economically justified.) In four countries—China, India, Indonesia, and Egypt—the government has established an oral contraceptive facility of its own. If international donors were to terminate the supply of oral contraceptives to the largest LDCs, these countries would be able to turn to local production facilities to meet their needs, but product selection would be limited.

The situation is somewhat different for IUDs and condoms. Here, the governments or local industries have been more active than multinational firms in establishing production, but only in a few countries. By and large, the world's largest LDCs depend on foreign supply of condoms and IUDs. Plans to establish IUD production in Indonesia are well under way and locally made IUDs should be ready for use in the national program by mid-1981. Several countries—Indonesia, Pakistan, Philippines, and Vietnam—are exploring the possibility of condom production. It is not yet clear whether these countries will actually establish a facility in the immediate future, but strong government interest will most likely result in the establishment of production facilities within the next two decades. Because reliance on outside donors is greater for these products than for oral contraceptives, if international donors were to cease supplying condoms and IUDs to the largest LDCs, these countries would not be able to meet their requirements from facilities within their borders. The situation is better for condoms than for IUDs.

Very few of the less populous LDCs have production facilities for contraceptive technologies. None appear to have facilities for IUDs or condoms, although condoms are made in a Japanese-owned factory in Malaysia. Several multinational pharmaceutical firms have set up production facilities for oral contraceptives in smaller LDCs, but these facilities are primarily to supply regional markets and provide only small quantities to the local private sector.

In summary, the situation is approximately as follows:

- Oral Contraceptives: The largest LDCs could rely on domestic sources of supply. The smaller countries have to rely on sources of supply from outside their borders.
- IUDs: A few larger LDCs could rely on domestic sources of supply. The smaller countries have to rely on external sources.
- Condoms: Several larger LDCs, if current plans come to fruition, will have domestic production facilities. Almost all other larger, and all small LDCs have to rely on external sources.

Almost all LDCs will be dependent upon external sources of supply for the technologies used in their national family planning programs during the next 20 years. How they meet these needs will be determined by an interactive process of review and discussion among the countries, manufacturers, and donors.

Should donors decide not to provide commodities support to countries in need, the decision on how to procure those commodities would clearly rest with the governments of the LDCs themselves, who would be free to procure either from multinational manufacturers primarily located in MDCs, or from manufacturing facilities located in other LDCs. If donors continue commodities assistance to LDCs, decisions on how and what to procure will have to be reached jointly between country and donor.

Most bilateral donors will require that commodity assistance be in the form of products manufactured within their own countries, as is the case with most current commodities assistance, which is provided directly in the form of finished products rather than as financial resources that can be used to purchase such products. Only multilateral and nongovernmental donors will be free to procure from any available MDC or LDC manufacturer.

From the LDC point of view there is something to be said for obtaining commodities support from multilateral or nongovernmental organizations, as this process allows a much wider selection of products to be obtained. But because bilateral donors—the funders of multilateral and (either directly or indirectly through multilateral donors) nongovernmental organizations—most often work under strong political pressure to procure from companies in their own countries, it is to be expected that most bilateral donors will remain directly involved in commodities procurement.

There are fewer pressures operating on multilateral donors to remain involved in procurement. One that does exist is from those bilateral donors funding the multilateral organizations who want to spread the financial burden of procurement and to have commodities appear as a small proportion of the bilateral's overall budget. Some bilateral donors, however, do not have contraceptive manufacturers in their own countries and are therefore more willing to have the multilateral assume the substantial logistical tasks of commodities supply to many LDCs.

The continued involvement of large bilateral and multilateral donors in commodities procurement is supported, however, by the economies to be realized by large-scale procurement of identical products, not only in purchase price, but also in distribution and storage systems. Yet it seems likely that more and more LDCs, even some of the smaller ones, will be willing to forego marginal economies of these kinds in order to have contraceptive technologies more appropriate to the particular needs of the country. The marginal economies referred to here are those gained by obtaining uniform bulk quantities of commodities rather than nonuniform commodities, an element that permits the concessional prices offered to public agencies by companies.

Commodity trade between LDCs

If LDCs exercise control over the procurement of commodities, one of the options available to them is to procure from manufacturers located in other LDCs; this option is receiving increasing attention. A recent review of population-planning activities carried out by the Association of South East Asian Nations (ASEAN) concluded that a high-priority future activity was the coordination of contraceptive production among ASEAN countries. In Mexico, an IUD manufacturer has recently granted the public-sector rights for sale of his product to other LDCs to the private, nonprofit PIACT de Mexico.

It appears that no LDC has directly purchased contraceptives manufactured in another LDC. UNFPA has procured condoms manufactured in Korea and shipped these to other LDCs, and there are probably other instances of multilateral or bilateral aid agencies procuring contraceptives manufactured in one LDC and shipping them to another. But LDCs do not generally procure fertility planning technologies manufactured in other LDCs. One reason for this is that program managers believe it is in the interest of the program to provide a product to users that is considered to be of international first quality. LDC consumers, as do MDC consumers, tend to believe—rightly or wrongly—that products manufactured in LDCs are unlikely to be of the same quality as products manufactured in MDCs.

A distinction needs to be made here. In several LDCs, MDC-based, multinational contraceptive manufacturers have established production facilities. If LDCs do begin to procure their own commodities, it is likely that they will purchase from these multinational companies, who in turn will manufacture the product in one of their LDC factories. In such situations it is conceivable that the product label will not show the country of manufacture or will show only the country in which the manufacturer is headquartered.

There is little indication at present that LDCs are prepared to purchase contraceptives from production facilities located in and controlled by either the government or local private businessmen in other LDCs, but a thorough survey of this matter is needed.

Additional conclusions

Multinational contraceptive manufacturers in MDCs will continue to be, to 2000, the predominant suppliers to most LDCs. They will not, however, supply most of the LDC population because the world's two most populous countries—China and India—will meet virtually all of their needs through local manufacture in government-controlled factories. But multinationals will have access to huge markets totaling several billion individuals and more than 100 million users of contraceptive methods. For the most part, these companies will supply their products to the public-sector portions of their markets (nonprofit family planning programs) under special low-cost concessional terms negotiated with public agencies and local governments. Supplies are likely to be made available to the private-sector portions of these markets under normal commercial terms at prices similar to those prevailing in MDCs.

A problem may arise in the interaction between the development of new contraceptive technologies and their production in LDCs. It is possible that LDCs that directly negotiate concessional purchases from the multinational manufacturers will have more ready access to new technologies than those LDCs relying on manufacture in government-controlled plants or in local factories controlled by local private individuals, or by multinational manufacturers. The specialized manufacturing know-how needed to produce the technologies likely to be developed and the complexities of patent regulations are likely to make access to these new technologies virtually impossible for LDCs that rely on local manufacturing operations. LDCs that establish domestic production capacity may thus be substantially limiting access to both new technologies and to future modifications of the technologies currently in production.

LDCs that procure from the international market will need to have capacities that permit them to effectively exercise their relative flexibility. They will need systems to help them identify new technologies, to decide whether a new technology will be useful to them, and to determine what options they have in its design, packaging, labeling, etc. These LDCs will also need the capacity to secure and transfer production know-how. Thus, LDCs that import a substantial portion of their commodities will not be able to fully rely upon the procurement mechanisms and logistics and supply systems set up by commercial manufacturers or donor agencies in obtaining the best products for their needs in a timely fashion. They will need to set up experienced, capable staff units within their national family planning programs to carry out these functions.

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Appendix E

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Appendix F

Commissioned Papers

1. Linda Atkinson, S. Bruce Schearer, Oscar Harkavy, and Richard Lincoln, "Prospects for Improved Contraception."
2. *Pamela Cain, "Future Prospects for the Development of Birth Planning Technology: What the Experts Think."
3. Pi-chao Chen, "The Evolution of China's Birth Planning Policy."
4. *Michael J. K. Harper, "Prospects for New or Improved Birth Control Technologies by the Year 2000 A.D.
5. *Paula E. Hollerbach, "Factors That Determine the Appropriateness of New Technologies to Consumer Needs."
6. Margaret McEvoy, "Factors That Determine the Availability of New Technology to Consumers."
7. Richard T. Mahoney, "Production and Distribution Capabilities for New Planned Birth Technologies Over the Next Two Decades."
8. *Michael T. Mertaugh, "Factors Influencing the Demand for Children and Their Relationship to Contraceptive Use."
9. Dorothy L. Nortman, "Factors Influencing Government Provision of Family Planning Services in Developing Nations."
10. S. Bruce Schearer, "Contraceptive Development by Public Organizations: An Assessment of Progress and Problems."
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12. S. Bruce Schearer, "How the Government Can Facilitate the Development of Improved New Birth Planning Methods."
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14. *John G. Stover and Jonathan T. Bye, "The Impacts of Population Growth on Less Developed Countries."
15. Steven N. Wiggins, "Economic Factors Affecting Private-Sector Innovation in New Planned Birth Technologies."

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